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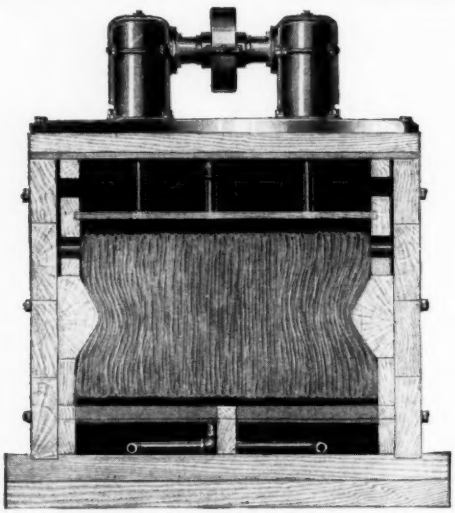
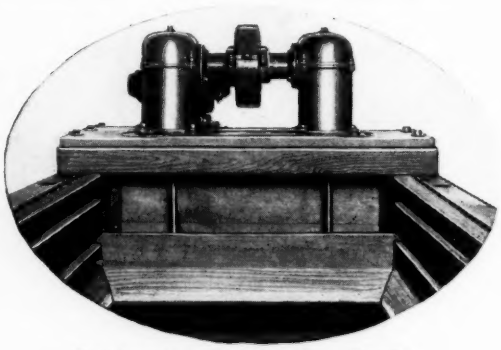


Sectional End View of Machine Loaded with Yarn



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American Dyestuff Reporter, Vol. XX, No. 9. May 11, 1931. Published Bi-Weekly by Howes Publishing Co., Inc., 440 Fourth Ave., New York, N. Y. Domestic subscription, $5.00; Canadian, $5.50; foreign, $6.00. Entered as second-class matter, Nov. 6, 1919, at the New York, N. Y., Post Office, under the Act of March 3, 1879. Copyrighted 1931, by Howes Publishing Co.

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Volume XX | MAY 11, 1931 | Number 9

Wool Substance, Its Chemical Nature and Reactivity With Acids

By **AMOS K. HOBBY**

W. C. Durfee Co., Inc., Boston, Mass.

Although man has been intimately associated with wool since the earliest days, it is still practically unknown to him in a chemical sense. The author summarizes very briefly the present knowledge in regard to the chemical structure of wool fiber, and then discusses the reactivity of wool toward acid, in water solution. Data is given to show that the relation between the amount of acid in the wool and in the water is a reversible equilibrium. Reactions with the following acids are discussed: Sulfuric, Hydrochloric, Tartaric, Acetic and Chromic.

WOOL, or hair, is a substance which has been in existence for a longer period than the human race. Yet, in spite of the fact that man has always been intimately associated with it, wool (and similar proteid compounds) is practically unknown in a chemical sense.

Dry wool is known to have approximately the following elements:

Carbon	50.8 per cent
Oxygen	21.2 per cent
Nitrogen	18.5 per cent
Hydrogen	7.2 per cent
Sulphur	2.3 per cent
"Mineral matter"	1.0 per cent

A complex proteid substance called Keratin is formed of these elements. Under normal conditions about 18 per cent of water is loosely combined with the keratin. When boiled with strong acids or alkalies the keratin breaks down into a number of relatively simple "aminoacids" which may be represented as

$$H_2N - (R) - CO_2H$$

(R) represents a wide variety of hydrocarbon groups, many of which contain amine, acid, or both groups. In the original keratin these aminoacids seem to be combined in large chainlike (or catenary) structures which may be represented as follows:

$$H_2N - (R) - CO{-}HN - (R) - CO{-}HN - (R) - CO{-}HN - (R) - CO_2H$$

Wool has the ability to combine with acids and bases (and with some salts). This combining power has been thought to be due to the "free" amine and acid groups. These groups can be removed, however, without markedly interfering with the combining power of the wool. We are forced to believe that some of the amido (—CO—HN—) groups are chemically active.

Heat is developed by the combination of wool with acids or bases. Vignon reports that 100 grams of wool liberates 24.5 calories when treated with a solution of potassium hydroxide (normal)—20.9 calories with sulphuric acid (normal).

The relation of wool and various acids are very important to those concerned with the manufactures of this material. We offer the following figures obtained in our laboratory, based on the action of a high grade of worsted cloth made by the American Woolen Company. In each case, five grams of the worsted cloth was treated with 500 cc. of water containing the stated amount of acid based on the amount of wool used.

SULPHURIC ACID (H_2SO_4).

Original acid used	Acid left in bath	Acid absorbed by wool
3.38%	1.03%	2.35%
12.82	8.72	4.10
85.7	78.6	7.1

The relation between the amount in the wool and the amount in water is a reversible equilibrium. If wool containing acid is treated with "fresh" water, acid will leave the wool until a definite relation is established between the concentration of acid in the water and that in the wool.

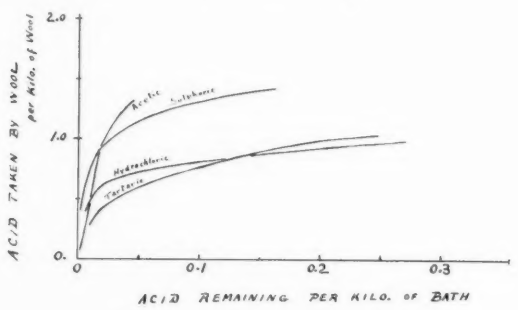
The concentrations of acid in the wool and in the

water, in acid equivalents (50 grams) per thousand grams follow:

Equiv. per 1000 grams Water	Equiv. per 1000 grams Wool
0.00205	0.470
0.01744	0.820
0.1572	1.42

It is apparent that wool has a distinct power of absorbing acid. At low concentrations, the wool has more than 200 times the acid concentration of the water. At the highest concentration observed, the wool has almost 10 times the strength of acid found in the water.

Hydrochloric acid is similarly absorbed by wool. For the same concentration of acid in the wool, about four times the concentration of hydrochloric acid is needed in the water as was the case with Sulphuric acid.



Hydrochloric Acid (HCl).
Acid equivalent—36.47 grams.

Equiv. per 1000 grams Water	Equiv. per 1000 grams Wool
0.0098	0.504
0.0225	0.648
0.0537	0.740
0.1287	0.860
0.2665	1.000

Tartaric acid requires a still greater acid concentration in the water to maintain a given acid concentration in the wool.

Tartaric Acid ($CO_2H(CH[OH]_2CO_2H$).
Acid equivalent—75.0 grams.

Equiv. per 1000 grams Water	Equiv. per 1000 grams Wool
0.0184	0.42
0.0490	0.60
0.202	1.06
0.426	1.14

Acetic acid is so extensively used in processing wool that its relation should be of much interest.

Acetic Acid (CH_3CO_2H)
Acid equivalent—60.0 grams.

Equiv. per 1000 grams Water	Equiv. per 1000 grams Wool
0.00219	0.1135
0.00486	0.2163
0.01005	0.497
0.01742	0.907
0.0456	1.313

Chromic acid is also actively absorbed, and extensive use is made of this fact for the development and fixation of chromium lakes in the wool fiber. Since, however, some oxidation of the wool takes place with a corresponding reduction of chromic acid, figures for direct acid relation cannot readily be obtained.

Book Reviews

Manufacture of Lakes and Precipitated Pigments *A. W. C. Harrison, Chief Chemist, William Harland & Sons, Ltd., Lecturer Polytechnic School of Chemistry, London. Second Edition. 274 pages, 38 Figs. Price 15 shillings ($3.60). One of the Modern Chemical Industries Series. Leonard Hill, Limited, London.* 1931.

The book, based as it is, upon the author's own experience as a lake maker, and his broad scientific knowledge of chemical technology accomplished two objects. First, the essentially practical treatment of processes as a means of producing satisfactory salable lakes, and second, the continual emphasis of the importance of strictly scientific methods in the production of such products in the works. There is every indication that the author as a chemist has studied the control of every stage of the various processes involved. The value of the book has been enhanced by the fact that more attention has been given to the details of plant arrangement, the manipulative technique of making batches and tests, and to the scientific principles involved than to the actual formulae of color making.

The author assumes that the reader has a working knowledge of chemistry, and that he can secure specific information in regard to the special dyestuffs used from the excellent booklets of the dyestuff manufacturers and his chief object in presenting the book is therefore to fill a distinct gap between the text books on chemistry, and manufacturers' publications, and supply the skilled chemist and technical man not only with a reference book, but with a treatise upon theories involved so that the reader may understand and successfully overcome many small difficulties encountered in the actual working of processes.

The following outline will give some idea of the comprehensive scope of the book: (1) Factory Design and Equipment, Layout and Installation. (2) Laboratory Equipment and Works Control, Methods of Testing, Intermediates and Discussion of Light and Color in Relation to Pigments, The Texture and Particle Size in Relation to Pigment Colors. (3) Inorganic Pigments including the Chromate Pigments, Cyanide Blues, and other important Metallic Pigments. (4) Pigment Dyes of the azo type produced by the coupling process, and pigment dyes produced by blending. (5) Lake Pigments. The Bases and Precipitants used. Lake Colors from Basic Dyes, Xanthrene Derivatives, Soluble Acid Dyes, Soluble Azo Dyes, Alizarine Lakes and Lakes for Natural Dyes.

An Appendix of 30 pages gives a Bibliography of

Books and Articles of General Interest and Tabulation of upward of two hundred different dyes, their shades and uses.

This book can not only be highly recommended to all technical men and chemists interested in Lake Manufacture, but certain portions should serve as an excellent text to general students of industrial chemistry.

L. A. O.

Deutscher Faerberkalender for the Year 1931 (40th Year)

Published by the Editorial Board of the Deutscher Faerber-Zeitung (A. Ziemsen Verlag, Wittenberg, Bez. Halle, Germany.) Pp. 236 (excl. indices, advertising columns, etc.).

This fortieth volume of the "Kalender" forms, as usual and appropriately, a small, compact book easily fitting into the pocket, and is bound in silver cloth, thus making it too conspicuous (though not glaringly so) to be readily overlooked when sought for after being carelessly laid down in the plant or laboratory.

The contents are as comprehensive as ever, the titles of the sections being as follows: Influence of the Use of Artificial Silks in Textile Goods upon Production and Consumption in the Textile Industry (Dr. Haller); Fastness and Efforts towards its Attainment (Dr. P. Rabe); Spray-Printing with the Spray-Printing Machine (Ing.-Chem. Rudolf Dax); The Development of Vat-Dyeing of Wool (Dr. S. Fuchs); Recent Methods for Working Up of Textile-Fiber Source-Materials (Dr. Adolf Gebhardt); Supervision of the Bleaching-Process and the Testing of Bleached Goods in the Plant (Dipl.-Ing. Alfred Schmidt); Solvents for Dry-Cleansing (Dr. Ernest Wulf); Tensile Strength Tests on Bleached Goods (Dr. W. Kind); Linen Bleaching (Dir. W. Erb); Chemical Testing of White Goods (Dr.-Ing. Erich Baur); Fast Hand- and Spray-Printing (Dr. F. Streng); Dyeing of Different Textile Fibers (Dr. S. Culp); A Process for Fast Wool Dyeings (Richard Kahl); Points in the Indanthrene Dyeing of Garments (Dr. A. Foulon); Dye-Chemistry of One Hundred Years Ago (Dr. Erich Friedemann); Silk Dyeing in the 18th Century (H. Rettberg); What Must the Employer Beware of in Discharging of Employees (Dr. Jur. G. Scherer) (this is of interest only to German employers, but it shows something of the scope of the work); Importance of pH Values (Dr. W. Kordatzki); and a large number of briefer, more technical and detailed articles, lists of new dyestuffs with their characteristics, various tables, etc.

Altogether, an interesting mixture of general and detailed, modern and historical information, some old but needing recollection, and some new. It would be a decidedly well-informed dyer or dye-chemist, could not find more than one valuable hint in some part or other of the work.

The work is in every way up to the standard set by the many preceding volumes, and must be very useful to those who do or who can read German.

Dyestuff Contacts in the Federal Research Program for 1932

By WALDON FAWCETT

IN NO private business has the beginning of the bookkeeping year anything approaching the significance which attaches to the inauguration of a new fiscal or official year in the Federal establishment. The occasion is of moment in the Governmental plant by reason of the fact that the annual appropriations made by Congress for the conduct of the Departments and independent Bureaus of the Government become available on July 1. By virtue of this mid-year allotment, all new projects and all noteworthy extensions of continuing programs start from the first day of the third quarter of the calendar year.

The fiscal year beginning July 1, 1931, will be no exception to the rule. In the Federal research program for 1932 are many projects which directly or indirectly will affect or influence the dyestuffs industry. It is possible to speak thus confidently so far in advance because the appropriations which are to underwrite these new ventures in Governmental investigation and experiment were made prior to March 4 and it was necessary for the administrative officials and technical experts to complete their plans for fresh or expanded endeavor six months in advance of the actual date of initiation of the work.

In any brief survey of what is ahead in research work of ultimate promised benefit to the dyestuff industry attention may well turn first to the Department of Agriculture because the agricultural annex of the Government is today on the threshold of its first wholly comprehensive, coordinated research program. Designed primarily, of course, to meet the problems of agricultural marketing and production which have become so acute under the changing conditions of the past few years, this program has, nevertheless, a number of contacts that should prove valuable and constructive for the dyestuffs industries and kindred interests.

The Department will spend this coming year upward of $100,000 for investigation and experiment in the utilization for coloring, medicinal and technical purposes of raw materials grown or produced in the United States. This is the largest sum ever devoted to this particular line of research. Much of the additional expense account which has been approved by Congress for use this coming year will be for explorative work designed ultimately to bring about the commercial production in the United States of chemicals such as tartaric acid, citric acid, etc., which are now largely imported. The plan of the Department is to investigate the action of certain molds upon sugar cane, xylose, glucose, corn starch, etc., to produce chemicals which are now produced by other and in many cases more costly methods.

This work was inaugurated some time since and con-

siderable progress has been made. Gluconic acid made from sugar as a fermentation product is an addition that has, in the short space of two years, seen the development of a method of manufacture to the point where the product is produced commercially. During the past year the Chemistry Bureau has developed a new acid known as Kojio, the value of which to industry is yet to be determined. Spurred by the enormous increase in recent years in the use of butyl alcohol and acetones, the Bureau of Administration is anxious to do everything possible to serve the fermentation industries.

Specifically, the budget of the Department of Agriculture for the year 1932 does not include an item for the extension of the work of the Color Laboratory of the U. S. Food and Drug Administration. Actually though, this institution and the scope of its research work will benefit by an increase of about $33,000 to enlarge the inspection and analysis of staple food products, including a lengthy list of food items in which artificial color is used. A fund of $30,000 is provided to establish this coming year a Vitamin Laboratory and to begin warfare on the food and drug preparations for which vitamin potency is falsely and fraudulently claimed. Incidentally it may be noted that the constant procession of new food products that are being developed as a result of modern discoveries in nutrition is complicating considerably the Federal supervision of the use of artificial color in foods.

Matching, for the dyestuffs industry, interest in the 1932 research program of the Bureau of Chemistry is that due for arousal by next year's schedule of activities at the National Bureau of Standards. Color standardization work will be carried on in much the same manner and with the same objectives as during the past year. This research program will concern itself with such problems as developing filters for the reproduction of sunlight and daylight and the determination of color temperature; theory of reduction of mixture data in colorimetry standardization of Lovibond glasses; construction of new color comparator for incendescent lamps; analysis of color stimuli in terms of dominant wave-length purposes; color specifications for railway and traffic signals; diffuse reflection and its measurement; and standard data on reflection of various materials.

The textile program of the Standards Bureau is to command an appropriation of $60,000 next year, an allotment which will enable a continuance of quests such as the investigation of substitutes for chromium in dyes. The cotton textile program, carried on, in certain of its aspects, in cooperation with the American Association of Textile Chemists and Colorists, is of ultimate as well as immediate significance, directed as it is toward the evolution of new or improved textiles through a better knowledge of the basic American commodity.

In the project to date, the institution has designed and built testing instruments and set up testing methods for measuring slipperiness, wrinkleability, permeability to air and moisture, fastness to light, washing, mill processing, cleaning and laundering, and resistance to abrasion. These properties are now clearly defined and capable of measurement. But in the opinion of the heads of this branch of the Bureau much similar work yet remains to be done. Under a sustained operating fund new attacks will be launched this next year upon the factors that remain unknown.

Holding no less tenaciously to a parallel quest, the textile research organization will, this next year, further its ambition to obtain a complete record of the effect of each of the construction variables upon the properties of a fabric. This assemblage of basic data is essential if industry is ever to completely solve the problem of making, upon demand, a fabric possessed of any desired properties. It should take the guesswork out of the erstwhile cut-and-try procedure and supply working guidance against specifications for fabrics which are beyond the range of all previous experience in the trade.

Incident to its search for facts, the Textile Section has, to date, in its adventuring in cotton, spun eight different sizes of yarn, each in eleven different twists and has combined these in different ways in fabrics. All of these yarns have, however, been spun and the fabric woven in the Bureau mill, using a single sample of raw cotton. It is felt that, for conclusive results, the work must be repeated using cotton of different grades and staple length. In the initial stage of this project all the fabrics and yarns referred to above were tested in the grey. Their properties are, of course, susceptible of modification by finishing processes such as mercerizing, bleaching, dyeing, calendering, beetling, sizing and coating. The study of finishing processes, which brings this whole program so much nearer to the dyestuffs industry, is no more than well entered upon. The work mapped out for the twelve months ending June 30, 1932, will carry this research drive well toward its goal. No interest, it might be observed in passing, stands to be more affected than the dyestuffs industry if the Bureau succeeds in routing the old tradition that all cotton textiles must, perforce, have certain characteristic properties and limitations. For every new property that is revealed as within the reach of cotton, when manipulated intelligently in the light of the technical and scientific information now becoming available, there should be a sequel of stimulated demand for dyes.

The 1932 program will doubtless duplicate the record of recent years in uncoverage of new research leads as investigative work progresses. An instance in point is the current work on the development of an accelerated aging test from which the serviceability of silks may be predicted. This supplementary project grew out of the major program of technical studies on the effect of tin weighting on the properties of silk. It will be recalled in this connection that the search for substitutes for chromium in dyes and dyeing was undertaken because the Quartermaster Corps of the War Department desired to be in a position to be able, in time of war, to demand the release of this material for military purposes without hardship to industry.

Proceedings of the American Association of Textile Chemists and Colorists

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CALENDAR OF COMING EVENTS

Council and Research Committees—
May 15—Boston.

* * *

Annual Meeting
December 4, 5—Boston.

* * *

Exhibition of Color at the Museum of the Peaceful Arts, 220 East 42nd Street, New York. Starts January 2nd and continues several months.

* * *

New York Section Meetings—
May 22—Paterson.

APRIL MEETING OF NEW YORK SECTION

THE New York Section of the American Association of Textile Chemists and Colorists convened Friday evening, April 24, 1931, at nine o'clock, at 220 East 42nd Street, Mr. Robert H. Gaede, Chairman of the Section, presiding.

Following routine business and announcements, the speaker of the evening was introduced, as follows:

Chairman Gaede: Those of us who were in the War know that some of the material that was used for uniforms didn't match properly and some of it washed out quite readily and faded. After the War the War Department got busy and standardized their requirements for fastness of Government material and Lieutenant Kirsner was instrumental in developing that fastness. Before that time it was quite haphazard, the method by which the Government ordered their material, but now it has gotten down to a very fine basis.

We are very fortunate tonight in having Lieutenant Kirsner, who has been responsible for the development of fastness in military fabrics, here with us. I take pleasure in introducing him. (Applause.)

Lieut. H. Kirsner: Your Chairman said that I was responsible for the development of colors. I dislike correcting him, but I would rather put it this way: that I have been perhaps responsible for the maintaining of uniformity of colors. The development of colors is really your job, but after having developed fast colors it is our job to see that we always get them, and that is what we try to do.

Lieutenant Kirsner then presented his prepared paper, making the following extemporaneous remarks:

Lieut. Kirsner: I think most of you gentlemen are acquainted with the fact that when you get an order from the Army you have to give exactly what we ask for, and we have the means of testing and finding out whether we get what we specify.

In the past four years we have had many disputes, some quite serious ones, but to my certain knowledge we have never had to take back or recant any action we have taken. So, apparently, our judgment is sound, because it is based on facts.

In the development of the olive drab woolen cloth, the standardizing of the raw material was the greatest step taken. Back in the latter part of 1927 we decided that we were going to establish as a standard 64's wool, that all of our specifications for Wool cloth for soliders' uniforms would call for 64's quality. Right there we had some serious battles with the wool sellers and also some of the wool growers. They contended that there wasn't enough 64's wool in the country. They said, "If the Army is going to use 64's wool what is the civilian to do?" And they said that by all means it was wrong for us to ask for 64's quality of wool. Anyway, they asked, how were we going to find out whether we were getting 64's or not?

"If you ask for a two-pound sample or a three-pound sample of wool," one large wool seller contended, "how are you going to sample that wool? If you get a two-pound sample of wool how can you tell that the 2,000,000 pounds that you buy to fill your order will all be like that?" He said, "It is impossible."

We agreed with him that that was impossible, but we merely made a change in the specification, changing just one word. We said, "shall not be lower than 64's." You can have it up to 80's if you want, but if we find any that is lower than 64's we will throw it out.

That argument was settled very quickly.

Only three years have elapsed and we already find that 64's wool seems to be the standard now even for the civilian trade. Not only that, but even the American farmers seem to be concentrating on growing 64's wool, and there is plenty of it in America.

As to the dyestuffs, I am going to give you another little picture on the question of fastness of color, or the necessity for it.

All of the various companies selling dyestuffs find that certain colors are fast in certain sections of the country and they don't give the matter any further thought, although you all know that a certain cloth that may sell very well in Texas doesn't sell so well in California. Why? You don't know. Perhaps you do know but you don't bother giving it any thought. The reason may be that the particular color that you are dyeing the cloth with, if the color is in question, may be particularly suited for California or Texas or Maine, but it may not be suitable perhaps for Alabama, or Louisiana, or perhaps Pennsylvania. Therefore, your competitor gets the business there.

That is simply an economic question and it straightens itself out without any difficulty.

The Philadelphia Depot buys for the Army as a whole and when we give a soldier a uniform, that uniform may have to be worn in every state in the Union. Not only that, but it may have to be worn in China, Alaska, the Philippines, Hawaii, or Porto Rico. We cannot call for types of dyestuffs that will be particularly suited for Porto Rico, or for Maine, because Private John Jones, who happens to be in the 56th Company in Maine now, may next week be transferred to Alaska, and he will have to take his uniform with him.

It is out of the question to ask the dye people to give us a color that will be just as fast in Alaska as it will be, say, in Alabama, but what we do is this: we strike a mean between all those various colors, the color that is best suited for all those places, and right there is our problem. A certain dye company will come to us and prove to us that their particular color, for instance, the olive drab, is absolutely fast—and it is fast in New York. They prove to us by civilian laboratory tests and actual usage that it is fast and ask us why we don't adopt that color, or why we don't eliminate from our specifications certain tests that keep their color out. Then we ask, "How will it stand up in Alabama?"

Well, they have to go there and find out, and while he finds out, we get a little rest. (Laughter.)

So there is a reason for our being exacting. Offhand you might think, well, they are awfully exacting. Perhaps they don't know what they are doing.

We had a case like that about two years ago. We were getting sewing silk, which called for dyeing with a vat dye. The tests to determine the fastness of that particular vat dye that that manufacturer was using was, in addition to others, to steep it in a solution of potassium permanganate, and also lime. Then, if the color stood, we said it was all right, but if it didn't stand we promptly rejected it.

One manufacturer—I think two—came down to see us. I spoke to this particular manufacturer. He was trying to convince me that our method was entirely wrong. "Why, the idea," he said, "to test silk with chloride of lime! Why, that eats up the silk and just makes it tender."

My answer was that we were not testing the silk, we were testing the color; that when we test the silk we test it before steeping it in the lime.

There have been some very interesting developments in our facing cloths. As you know, about two years ago we thought that the Army was going to adopt blue uniforms and we went out on the market and tested all our specifications for blue uniforms by buying some 30,000

yards each of those blue numbers. We found by the way that our specifications were all right. They were perfect. But the problem came in connection with the trimmings. Of some of the trimmings we only need about 100 yards a year, and when we started to buy them we found that we simply couldn't get them to anywhere near match the colors that we wanted. Finally, after considerable trouble, we decided that we would have to buy each of those numbers by the 1,000 yards in order to assure uniformity of color. But in the process of buying these 1,000 yards we found this:

Take this Scarlet—I am particularly partial to the Scarlet because most of my service has been with the Artillery and I have worn a good deal of Scarlet. That Scarlet never was very fast. When you had a stripe on your trousers to denote your rank and title, inside of six months you would have to renew that Scarlet stripe, because it had faded so. It would become unsightly.

We were very fortunate in getting this Scarlet (indicating) which is developed and dyed with a dyestuff that is absolutely unbreakable. You cannot break that down. it stays put. It is true perhaps that it hasn't the brightness of Acid Scarlet, but then the brightness of Acid Scarlet only lasts long enough to sell the goods, while this remains "put." It is a very commendable development, whichever company has it.

Another one is this light blue used by the infantry.

This color also was very fugitive (indicating)—more fugitive than the Scarlet. The color we used to use is much brighter—especially in this light. They don't look the same at all. This is a bright Blue while this is a subdued Light Blue, yet this bright Blue will get almost white in less than thirty days. The second dry cleaning will make it almost white, whereas this will stay "put" exactly as you see it. We have had it in the Fadeometer for 176 hours, which corresponds to thirty days during the months of July and August, and the Fadeometer didn't even cause a discoloration, whereas this one was bleached white in less than 50 hours.

I want to show you some interesting developments in fabrics with which some of you gentlemen may be acquainted.

We call this fabric (indicating) a cavalry twill, or an elastic twill, and up to 1928 all of it that gave any satisfaction at all came from England. It was made around the Leeds district. One or two companies had attempted to make it in this country, particularly one. They were fairly successful, charging us something like $9.60 a yard for it. But when we got that cloth it wasn't very uniform. I mean to say it didn't look like a high-grade cloth, like the foreign cloths. On looking into the matter we found that the makers of the foreign cloth double-draw their yarn in spinning, whereas we here didn't do that, and then they had a knack of slow-spinning which gave them an extremely uniform yarn, and as a result these lines that you see there were very elastic. It is almost like a piece of rubber.

We had a contract with one American firm for some five or six thousand yards of it and they made an awful mess of it. We went down to see them and found they had done the best they could and we felt that if the fabric didn't come out exactly right it wasn't entirely their fault, that they had undertaken to do the impossible, so we immediately set out to see how we could get a cloth like that that would be satisfactory here in this country.

We redesigned it on the worsted system, instead of the woolen, and in designing it we tried to make that cloth resemble a piece of woolen cloth as nearly as possible. The first thing we decided was that the French spun yarn was just soft enough and felt almost as good as a woolen. So we prescribed in this cloth a French spun yarn throughout, and we gave the manufacturer the layout. We buy this cloth in large quantities for officers, say, five or six thousand yards every two years and we pay about $6.00 a yard for it. It is made of a raw material almost two times as high in quality as the British woolen or the former woolen elastic that we used to buy. This cloth that I have here has a tensile strength of 220 pounds to the inch, whereas the woolen cloth had a tensile strength of only about 105.

One general officer aptly said it was made for a Cavalryman, all right. He said, "If he happens to be a bad Cavalryman and lands on a wire fence, that is where he will stay, because if this hangs up on a wire fence, that is where it will stay, and he will not come down." (Laughter.)

The same fabric is also used in the Olive Drab, just for breeches. Traditionally we used to clothe our Army in Meltons. As you fabric men know, Meltons are not very strong. If they test around 35 pounds for civilian life, they are considered a very good cloth, yet our Meltons were tested at 60 pounds and 65. That is what we ask for. Yet the Army thought it wasn't strong enough. Before the War they thought it was just fine, but when we became more cloth-conscious after the War they said it wouldn't do.

So recently we made a change and instead of using Meltons we began using worsteds for the troops.

In connection with this change, we went further still. The question of color entered into it. That is what you are interested in mostly. We took that question up and this is what we did: In the first place, we designed a pair of trousers that we could safely say would outwear any

five pairs of Meltons, because the actual tensile strength of this pair of trousers is around 200 pounds, whereas the tensile strength of the Melton was around 60. The weight of the Meltons used for trousers used to be around 16 or 17 ounces. We increased that to 24. I will tell you why very shortly.

In regard to the coat, we now give the soldier a serge coat, 18 ounces, and this is where the question of color came in. When you line up a company of soldiers all dressed in the same color, blue, white, or anything else—a solid color, coat, trousers or breeches, and cap of the same color—even the slightest difference in color between the coats or trousers of the successive men is immediately discernible to the naked eye and you get the general effect of non-uniformity. But take a line of soldiers dressed for instance as I am right now—dark coat, light trousers and perhaps a light cap—even though my coat may be four or five shades darker than that of my companion, or my trousers may be four or five shades lighter, or darker, the general appearance is that they are all uniform.

So that was the principle we applied in designing this uniform. We gave them one color for the trousers and another color for the coat. Here is the color of the coat. It was modeled after this old coat of mine. There is the difference (indicating). We couldn't give them anything as light as this because for the average soldier his cleaning bill would almost break him. So we gave him the nearest thing to that and there it is. Of course, that helps out you dyers and colorists. But that doesn't mean that we are going to let up on uniformity of deliveries. Our deliveries will have to be just as uniform as ever.

There is just one more thing I want to touch on. I am talking on a subject in which I am interested (of course by official order) and I may not know when to stop, so perhaps I had better stop pretty soon.

On the question of foreign competition, I want to show you this. We have eliminated the necessity of Army officers calling for foreign cloths. It was only four years ago when the average well-dressed officer had a uniform made entirely out of foreign cloth. I am wearing an old blouse that is about six years old and I am sorry to say that this blouse is made out of a piece of foreign cloth, because I haven't made a new one yet.

We brought that condition about by merely raising the quality of our cloth to such an extent that there isn't a foreign piece of cloth that can compete with us. That is exactly the situation as it exists today and it is well-known. Not only that, but we have made that material available at such prices that even if they should have a fabric complex and think that they are better dressed if they use British cloth, they will hardly think of paying the difference in cost. So the desire for foreign cloths was eliminated you might say by auto-suggestion, and actual facts.

As to the facts—recently there has come to me a collection of uniform fabrics, particularly from Germany, Czechoslovakia and Austria. A tag was attached to each piece of cloth giving the price in the foreign country, without duty, based on a quantity of 1,000 yards each. When I reduced their prices from marks to our own American dollars I found that our cloth, of much superior quality, even with the prices we pay for American labor, is cheaper over here than theirs is there, without even adding duty.

I think the American public should know that. I have the samples with the actual prices. This collection was gotten by a very reliable machine builder in this country who by the way is German-born. He knows the ropes and knows that what he got are the facts. Nobody put anything over on him. And he isn't a cloth manufacturer. He is entirely disinterested.

Communication

Dr. Louis A. Olney. April 17, 1931.
Chairman Research Committee,
Lowell Textile Institute.

Dear Sir:

In the discussion following Mr. Cady's very interesting paper on The Peculiarities of Fading (A.D.R., p. 237, 1931), the question was raised as to the cause of abnormal fading in sea air.

It seems to be generally agreed that there is some other serious factor entering into this fading phenomenon other than sunlight and humidity, and although salt, as suggested by Dr. Chapin, may be the malign influence, there seems reason for thinking that this may be due to the presence of ozone. Although doubts have been raised as to whether this "ozone" may not be something else—hydrogen peroxide, chlorine or nitrogen oxide—there is undoubtedly some oxidizing agent present which is absent from city air and it may be this variable which accounts for some of the very disturbing complaints that are occasionally made of light-fast dyeings when exposed near the coast.

I cannot recall seeing published any experimental work on the causes of abnormal fading in sea air, but for manufacturers specially interested in the problem it might prove profitable to investigate the fastness to light of dyeings in slightly ozonized air as well as to the possibility of increasing this fastness by special finishes.

Yours faithfully,

Raymond Curtis,
Quidnick Dye Works, Inc.

Proceedings of the American Association of Textile Chemists and Colorists

Color and Fast Colors in Fabrics for Military Purposes

By Lieut. H. Kirsner

YOU perhaps are wondering what important relation color could possibly have to things military. Olive drab, khaki and perhaps blue are the color associations that may spring to your minds when thinking of military fabrics. Color may be a very important factor in commercial or civilian life where the sales appeal is uppermost, but, you may think to yourselves, what possible important place could it hold in military life? And it is this question that I shall endeavor to answer by first tracing the inception of this problem, its present status and attempted solution. Let us for a moment trace the historical background of color in military organizations.

In looking over military organizations of the early periods, you find that the uniforms were a mixture of bright flamboyant colors. Upon second thought, it is seen that when the combat was a hand to hand fight with instruments of close striking power, it was essential for the combatants to be able to distinguish in the general melee, friend from foe, and basically, therefore, the bright colors were then a military necessity.

As the fighting equipment of combatants was perfected, where it was possible to strike the foe at a distance, the bright and distinguishing colors gradually became a liability instead of an asset to the military organizations, and gradually, it was necessary for them to tone down the colors of the uniforms so as to make a lesser distinguishing target. Hence the colors of the uniforms were revised from time to time.

With the advent of the high powered musket or rifle, it was necessary for the military organizations then to seek protection from the marksman's eye, and the thought of the military then turned to masking the troops. The general method in favor was to garb them in uniforms closely resembling the natural objects of the terrain where the combat was in progress.

The many changes that have taken place in the uniform of the American soldier was also undoubtedly effected by the experience taught the troops in combat in the territory where it took place. Before the Spanish American War the main garb of the soldier in the field was blue. After the Spanish American War a change was made to the khaki color. That change, perhaps, was dictated by the fact that the Spanish American Campaign took place in a tropical climate and the material of the uniforms had to be made lighter and perhaps the greater comfort was obtained by making the uniform a color cooler than the blue.

Later, during the Philippine Insurrection, another change was made from khaki to olive drab, it blending better with the green foliage of the territory in which the troops operated and thus better masking the soldier.

During the late war, the olive drab was retained and found to be particularly adaptable to the warfare in Europe and as some have well expressed it, the uniform well matched the muddy trenches in France.

For open warfare, it was thought that the horizon blue of the French or the gray of the Germans might have been more appropriate than the American's drab.

It will be interesting if I cite briefly how some of the colors for the uniforms were determined. In the case of the Germans, I am reliably informed that they took their resultant color of gray from a ground mixture of partridge feathers. It is stated that the color of the olive drab was taken from a ground mixture of leaves and in the case of the blue of the French it appears to be a duplication of the artist's conception of the horizon. While at present manufacturers are obtaining their color schemes from either objects of nature or objects of art, this system is not new.

Culling bits from early days we read: "In the early part of the Revolution part of the troops assumed the dress recommended by Washington—a hunting shirt, long gaiter breeches made of tow cloth, *steeped in a tan vat until it reaches the color of a dry leaf.*"

Of course, General Washington's selection of a tan may have been somewhat actuated by the fact that the tan or brown colors were most easily obtainable in that period as those colors were favorites among the Quakers of Philadelphia and because of their demand the dyes were obtainable on every farm. Brown or tan was the prevailing hue of cloth manufactured in this country during the Revolutionary period. So much for the history of color for uniforms.

Uniformity was always a concern to the military. The reasons why they are so sensitive to differences in shade is undoubtedly due to the fact that an opportunity is afforded them to make closer comparisons of clothing than civilians. When military organizations are lined up for inspection, there are many wearing the identical cut and color garment and slight deviations of the color or shade immediately become distinguishable even to the inexperienced eye.

We note from the Congressional Record of 1780, the recommendation of General Washington: "As nothing adds more to the appearance of a Corps than exact uniformity of dress, the General recommends it thus early to Field Officers newly arranged to fix upon a fashion for the regimental clothing of the officers of their respective corps. The General sees with concern the difficulties which the officers labor under in procuring cloth. It is not, therefore, his wish that those who are already furnished should run themselves to the expense of new uni-

forms, if their old are not exactly conformable, but that they should in the future comply strictly with the regimental fashion and if possible get their old clothes altered to it. It has a very odd appearance especially to foreigners to see the samples corps of officers each differing from the other."

And so the military men of today have received the heritage of uniform and color from their military forbears of yesteryear to ponder over. This present problem resolves itself into two distinct phases:

1. Difficulty of securing uniformity of color.

2. Difficulty of securing comprehensive fastness of color. The four main causes of the difficulty in securing uniformity of color are as follows:

1. Numerous sources of supply.
2. Storage of cloth over long periods of time.
3. Large scale tailoring of uniforms.
4. Unstable and fluctuating organization of military units.

The method employed in securing textiles for the manufacture of military uniforms is as follows: First, invitations to bid are sent out to mills eligible to make the type of fabric desired. Sealed bids are then received from the manufacturers and on a certain date at a certain time the awards are made to the lowest bidder or bidders complying with all requirements set forth in the proposal. Peculiarly, this arrangement, due to the large quantity of cloth desired and the keen competition, works out generally so that the total quantity is divided up among a number of mills.

Naturally enough, each mill may not use exactly the same type of raw stock, even though the quality is up to specification requirements. One may use an Ohio wool, another a Texas wool, and still another, a Montana wool —all slightly different in their complete chemical makeup, which means that they will not dye exactly alike even though the same formula is used and the processes of manufacture are exactly alike. The fact is, as in the case of raw stock, they may use different dyestuffs so long as they satisfy the fastness requirements of the specification. However, certain processes such as steaming may cause the one type of color to become redder, whereas, another type may become yellower after being subjected to the identical steam treatment, tending toward a variation of shade as between different manufacturers. In the same way, a variation in the mechanical processing from raw wool to finished fabric may also cause a difference in shade.

These three factors, raw stock, dyes, and method of manufacture, variations in which tend to make the uniformity of color of cloths from the various mills diverge from the normal desired or sought work against uniformity of color from numerous sources of supply.

When the cloth from the various manufacturers is received at the clothing manufacturing depot, it is amalgamated into a common stock from which the uniforms are to be manufactured. However, this cloth may not be used immediately, which means it is stored away until such time as it is needed.

Perhaps you may suggest that we use cloth from one manufacturer for each order, but what is to be done when there isn't a delivery from one manufacturer large enough to complete the order?

Large scale tailoring as required for the military service means an order for the manufacture of uniforms in a quantity ranging from 100,000 upward at one time. Let us note the method of procedure.

The first step would be to lay out layers of cloth, thirty to forty yards long—mark out the pattern for one component of one size and cut out. This may be the coat or the breeches, which is cut out from the cloth as it is drawn from stock. All of this cloth may not be from one manufacturer, which helps to make greater variations as between the separate components of the uniform.

When all the uniforms are made up, instead of packing them by suits, they are usually baled or packed separately. For instance, forty-five pairs of breeches, sixty pairs of trousers or thirty-six coats to a bale. Then when a requisition is received from a particular organization, or supply office, for so many thousand uniforms, the supply depot withdraws from stock the required number of bales of each of the sizes and ship them to their respective destinations. Then at the post, in fitting the individual soldier, the officer in charge will extract the size breeches, and the size coat that the soldier's measurements indicate he wears and usually two garments made from cloth produced by different manufacturers will be issued him. All these factors, large scale tailoring, baling of separate components of uniforms and the method of fitting the individual soldier at posts, tend to work against the obtaining of uniformity of color.

Military units are rather unstable in their makeup. We find a grand conglomeration of men who have been in the service but a week or so mixed with the more seasoned veterans of a year or more of service. Due to transferring and shifting of personnel of military organizations, we can safely state that seldom more than 50% of the total number of men in a military unit have been more than a year in the same organization, while the remaining members have been recruited by transfer from similar units in different parts of the country. Their uniforms are transferred with them and naturally enough the condition of constant flux tends to make the problem of uniformity of color more troublesome.

Based upon the representations of the manufacturers, it has been the practice in years gone by to give the manufacturers two and sometimes three samples to which they

could match deliveries of cloth. Experience, however, has very definitely established the fact that this practice has resulted in an attendant laxity and carelessness in achieving uniformity of color. Under this old system we see here on this card the rainbow arrangement of colors that are supposed to be one and the same, which were deliveries received at the Quartermaster Depots in previous years. Even at quite a distance the distinct differences in shade are quite glaring. Even deliveries from the same mill had a staggering variation.

Therefore, in late years, we have cast aside the old system and now the manufacturer is given a single sample to which he must match deliveries for color. This sample is taken from the standard sample which is kept at the receiving depot and used to match deliveries to when cloth is received from the mill. Now let us see the results of this system. Here we have a card representing deliveries of the same cloth recently purchased. Now we find a much closer match between mills as well as between deliveries of the same mill. Even at close range the variations in uniformity of color are not so easily discernible.

Generally speaking, it is not difficult to match a shade to a sample in the laboratory and perhaps in the coming years with the development of spectro-photometry and the photo-electric cell on a more secure basis in the matching of colors, insofar as the laboratory is concerned, this problem will become a mere routine but the exact reproduction of colors in cloth will forever depend on the human equation and on the skill of the dyer, improvements in machinery perhaps greatly helping in obtaining the results.

Now let us see what the difficulty is in regard to fastness of color. Nature produces the fastest colors for her creatures and plants. They are made to stand all sorts of conditions. Nature is to be as closely emulated as possible for the reason that military fabric must stand all possible conditions under the sun from those down in Panama and in the Philippines to those up in Alaska. And so these colors must be fast for the most rigid requirements. We cannot think of conditions here in the East alone when we make sunlight fastness tests. We must think of California, Panama and such places where the sunlight is the most severe. The requirements must be at the maximum at all times to be available for use whenever needed. For instance, a soldier who is stationed at Fort Hancock, New Jersey, may tomorrow be transferred to the Philippines where the strictest fastness will absolutely be required. For ordinary commercial fastness or usage, a fair fastness may be good enough, but in military circles the best is always found to be the most economical. Then also the consideration of situations with possible effects of gas and acid have to be considered. Even though peace time cloth, it must be made strong enough to resist the possible contingencies of war.

Heretofore, in the dyeing of facing cloth, acid colors were used which, as we all know, are fairly fast and good enough for commercial uses. However, the military authorities felt that these acid dyed fabrics did not stand up under chemical and sun fastness tests as well as desired. They were not to be deterred from finding more suitable colors which would meet the required high degree of fastness. Cost was no consideration from the point of view of initial outlay and so they had experiments conducted with vat dyes on wool which are very little used and very expensive. The results of these experiments proved that vat dyes did conform to the very high degree of fastness required and as a result our present fast color on facing cloth.

For the past two years we have been investigating the fast colors on cotton cloth. Vat dyes on cotton cloth cannot be said to be a new innovation. The trade has used vat colors on cotton piece goods for perhaps a period of ten years but as you all know the degree of fastness that can be obtained by vat colors depends entirely on the combinations of colors used. The military field is not so much interested in the method of obtaining an article as it is interested in the result, that is to say, the result is of prime importance and we usually leave the method entirely to the manufacturer. But there comes a time when the method may have a decided bearing on the result of the fastness of color. A case in point is the application of vat dyes to cotton cloths and the final decision as to how it should be handled. After a period of about two years' experimentation we found that, generally speaking, the vat colors on cotton are fast, provided however that a proper penetration has been obtained in their application.

Many attempts were made to fix the color of the olive drab cotton cloth so that it would not bleach and wash out to a dirty brown or white. Attempts in that direction ranged from making up samples of cloth by dyeing the raw cotton before it was spun, dyeing the yarn before the cloth was woven, to mixing various dyed yarns in an endeavor to obtain a resultant effect of an olive drab mixture that would be stable and would not break down in washing.

In all these attempts, while some proved slightly better than others, the general result was unsatisfactory as invariably factors were injected that made procurement of any of the cloths in such quantities as required by the Army, impracticable.

In the Spring of 1928 the Office of The Quartermaster General took definite steps to develop a cotton cloth that would be an improvement on the then olive drab cotton and which would be generally suitable for uniforms.

As a result, a meeting of producers and finishers of cotton cloth was held. It was agreed at that meeting that

the Quartermaster Corps should furnish a set of requirements in general terms covering the needs of the Army for the desired cloth and its color fastness. Accordingly, the Philadelphia Depot drew up and distributed to the cotton textile trade a set of general requirements.

Thereafter, numerous samples embodying various types of spinning, construction and dyeing were submitted through 1928 and part of 1929 by manufacturers for test by the Philadelphia Depot in accordance with the tentative requirements.

Results of the tests on these samples indicated that the principal fault with the color was the fact that on scrubbing, the cloth invariably turned white. Careful analyses indicated that this condition was due to the fact that on scrubbing, certain fibres were raised on the cloth and the dyestuffs physically removed from the tips of these fibers, therefore giving the white appearance. In other instances, it was indicated that while the dye used withstood all the chemical tests (the assumption therefore being that the dyestuffs represented the best quality in possession of the trade), the scrubbing tests, however, showed that the method of application of these fast dyestuffs was faulty.

The problem then became, how to overcome the mechanical breaking down of the color. A study indicated that the solution to the problem was to devise a method of not permitting as many cotton fibres to come through the cloth itself as was previously possible.

Early in 1929, it had become evident to the Philadelphia Depot that while considerable strides had been made in obtaining a degree of color fastness on the dyeing of cotton cloth, the principal fault appeared to be mechanical. During the many conferences held between the representatives of the Philadelphia Depot and the trade it was apparent that there was a general disinclination of the cotton trade to venture into what may be said to be a "New Field," that is, they all agreed that the fault of lack of color fastness was due to mechanical rather than chemical action but they could not agree as to the manner in which it could be overcome. The Philadelphia Depot suggested that a method be devised wherein the cotton fibres in each thread would be so processed that it would be more difficult, in scrubbing, for individual fibers to come to the surface. After several unsuccessful attempts to have the trade experiment along this direction, the Philadelphia Depot prepared a specification which calculated in the main to cover this requirement.

The specification prescribed that all the yarns were to be combed for the reason that when fibres are combed, the structure of the yarn itself is such, that each fiber then lies perfectly parallel to its neighbor.

It was provided in making the thread or yarn that it should be double or two-ply instead of single. This was done to again provide a medium of more closely burying the tips of the fibers in the yarn itself.

To afford better penetration of the dyestuffs, the specification provided that the cloth before dyeing be made perfectly absorbent and that was to be done by having the cloth fully mercerized and bleached. The truth of that can be tested by almost anyone familiar with cotton. If a small quantity of unprocessed cotton is immersed in water, it will be found that the cotton will not absorb the water but it will float on the surface. This is due to the natural waxes of the cotton coating the fibers, thus preventing the cotton from absorbing water, but if the cotton is mercerized or bleached then it becomes absorbent and when immersed in water it will immediately sink to the bottom of the vessel. It was this principle that was embodied in the specification to provide for a greater dye absorbency in the khaki uniform cloth.

For the purpose of testing the specification, the Quartermaster General approved the recommendation of the Philadelphia Depot to make an initial purchase of 10,000 yards. Accordingly, invitations for bids were mailed to the trade April 12, 1929, thus broadcasting to the cotton textile trade the specification in the form of an advertisement for a quantity of the cloth and at the same time testing its practicability before purchasing large quantities.

It is interesting to note that after the invitation had been out in the trade for about ten days, personal and written protests were received by the Quartermaster General's Office and the Philadelphia Depot stating in effect that the specifications were entirely theoretical, extremely impracticable and even alluded to the idea that they were prepared by someone not familiar with the trade and stating in fact that it would be impracticable to produce the tensile strength called for on a cloth as light as 6-ounces per linear yard of 28-inch width. So vigorously did the protests continue that the Quarter master General deemed it advisable to have the Philadelphia Depot test the specification it had prepared by having a sample piece of cloth produced under its direction.

The feat of producing the sample is rather interesting. The trade as a whole maintained that the cloth could not be produced. The Philadelphia Depot has no spinning, weaving, dyeing or finishing facilities for the production of samples, yet the production of a sample within the shortest possible time was of the utmost importance as the Philadelphia Depot had a large accumulation of orders for cotton uniforms which could not be filled until a satisfactory cloth was produced.

Bids on the 10,000 yards of experimental cloth were to be opened on May 13, 1929, but in view of the contentions of the trade, the Philadelphia Quartermaster Depot recommended to the Quartermaster General that it be permitted to postpone the opening for one month, maintaining that in that time it would actually bring about the production of the sample and present it to the trade

and the Quartermaster General and disprove the claim that the cloth could not be produced.

Before the end of May the much disputed sample was actually produced, presented to the Quartermaster General and the trade, and thus the contentions of some of the cotton cloth producers were disproved and the production of the cloth became an accomplished fact.

It is interesting to note that whereas the disputed specification called for a tensile strength of only 125 lbs. in the warp by 90 lbs. in the filling, the sample produced by the Depot did not vary in weight as much as 1/10-ounce from the original 6-ounces set by the specification and it had a tensile strength of 185 lbs. in the warp by 112 lbs. in the filling.

There was a further contention as to price, some maintaining that the price would run as high as 60c or more, while the figures compiled by the Philadelphia Depot indicated that in no instance should the price be more than 48c per square yard. The postponed bids for the 10,000 yards were opened June 13, 1929, but they were all rejected for the reason that it was no longer necessary to make an experimental sample as the Quartermaster Corps had otherwise brought about its production; therefore, the 10,000 yards were no longer required.

One thing, however, this bid opening proved—the prices were within reasonable limits; in other words, the average price bid was around 45c per square yard and purchases made since were about 42 to 43c per square yard. And now we are purchasing the cloth at around 36c per yard.

I think that is about all I have to say unless there are some questions you care to ask me. (Applause.)

Chairman Gaede: Are there any questions anyone would like to ask Lieutenant Kirsner? We have had a different problem presented to us tonight than anything we have had for some time, and that is the application to which fastness and manufacturing problems are put, and I am sure there are some here who would like to ask questions on this subject.

W. E. Hadley: In regard to the treatment of silk thread with chloride of lime, I can't just get that clear in my mind. If you were out to use a silk thread, what difference would it make whether your color would stand the lime, inasmuch as the silk would never receive a treatment of lime anyway?

Lieut. Kirsner: That is very good.

The problem is simply this: When we send out a uniform to Texas, particularly a washable uniform which has been sewed with silk, it will be washed by some local laundry and the water condition there may be such that it will bleach the thread.

We take that same uniform perhaps and send it out to the Philippines. There we have a water condition which is quite different from that in Texas, but that water also will bleach that thread. Yet it won't tender it.

We come to Maine and we find still another water condition there.

In our tests we cannot get specimens from the Philippines, or Texas, or Maine. The time element makes that absolutely impossible. We wouldn't be able to buy anything.

So this is what we do: In order to get something that will take care of all those conditions we say, "We want a dyestuff used on that silk thread that we are going to sew that garment with that will not bleach by lime," not thinking that we will ever use lime on it, but if it will not bleach by lime then the condition of Texas is taken care of, and the condition of the Philippines and Hawaii, perhaps China, and also Maine. We never had any thought of using lime. We never would think of it. Just imagine what would happen to a piece of cloth, cotton or wool, if we steeped it in lime. But the purpose of the lime test is to see how strong the dyestuffs are.

If we knew that there wasn't a dyestuff that would stand that we wouldn't prescribe that test, but in our experiments we found that there was a certain type of vat dye that will stand that treatment, therefore we want it, and we specify that test, rather than prescribe the dyestuffs by name and discriminate against certain companies. So we make you use that particular dyestuff and yet we don't tell whose it is. (Laughter.)

There is your answer.

Mr. Hadley: That particularly impressed me at the time you mentioned it because I recall that several years ago the Government got out some kind of specification for cotton thread and it called for the dipping of the cotton thread in a concentrated muriatic acid. It appealed to me that the same condition existed here because your thread would never be dipped in concentrated hydrochloric acid. I should think if the Government and the Army wanted to specify a certain color they would lay down a more scientific approach, rather than use a bleaching powder which will destroy the silk, or so brown the silk that you won't know just where you're at. Specify Anthrene Blue GCD (with apologies to Newport) or Indanthrene Blue GCD (with apologies to General)—I should think that would be the line of approach, rather than the one you are using. It is just like going out to buy a glass case and hitting it with a hammer to see if it will break. (Laughter.)

Lieut. Kirsner: I am glad you brought up that question.

In the case of the lime that was put in to make you use a certain dyestuff and the case of the muriatic acid that was put in to exclude a certain dyestuff, we don't want

to name dyes or do anything that produces that condition. There is your answer. So you see it works for and against. When we get to the facts and find a really scientific way to overcome it, we use that method.

Mr. Hadley: I had a case several years ago where a laundry was treating a certain type of towels which were marked with a Hydron Blue, and they were going to great pains to see that the chloride of lime was thoroughly strained and made up to a one degree strength, or twaddle strength. It was piped around through every laundry wheel. We couldn't make up our minds why this Hydron Blue was being stripped until I found some galvanized pails setting around, in which they had 12 or 15 pounds of chloride of lime and 4 or 5 pounds of soda ash. When a particularly dirty lot came along they would fill a pail up with warm water, stir it with a stick, and after the final soaping treatment while the goods were so hot you couldn't put your hand in, if they couldn't get the dirt out they would make up a mixture of that chloride of lime and soda ash and put it in the laundry wheel. There didn't seem to be any reason why they should take all the trouble to strain out all the particles from that chloride of lime—

Lieut. Kirsner: Why use the chloride of lime at all?

Mr. Hadley: Frankly, I don't know.

Lieut. Kirsner: If they were washing my towels I wouldn't permit them to use it at all.

In that connection I will say that chloride of lime has a certain use. In a laundry it may help the washing a little bit, but I don't think it helps the cloth any.

Mr. Schroeder: Is your allusion to lime treatment confined to bleaching?

Lieut. Kirsner: My allusion to lime treatment is this: If we find in an Army laundry that they are using lime in washing cotton cloth, the superintendent of that laundry is fired. That applies to either lime or peroxide.

Mr. Schroeder: What I was referring to particularly was your reference to the lime contained in the various waters. That is not a caustic lime and it is only the presence of other substance that it has any effect as far as bleaching is concerned.

Lieut. Kirsner: I am speaking about chloride of lime that laundries use to get quick washing effects.

P. J. Wood: Mr. Chairman, I agree with Mr. Hadley in his remarks regarding the use of this chloride of lime test on silk and I disagree entirely with the Army. (Laughter.)

I think I would characterize tests of that sort as chemical gymnastics. I don't want to be too harsh on the Army because they bear arms. I don't. (Laughter.) I think a lot of those tests bear revision.

It wasn't so long ago that we could have found fault with some of the tests of the Bureau of Standards. I recollect distinctly a drapery customer we had who used to test his draperies by putting them out on the roof and he said if they stood the ice and snow and soot of New York City they would stand anything they came across inside a house—and they didn't stand that treatment very well. Then he sent them down to the Bureau of Standards and they boiled them an hour with soap and soda and they said they wouldn't stand washing. (Laughter.)

I pointed out to them that most of these draperies were dry cleaned, as a matter of fact—they were a mixture of wool and cotton. But that didn't make any difference. If the Bureau of Standards said that was the test, that was the test.

And so it went—and they had a very long treatment in the Daylight Lamp. And it seemed to me it was altogether unreasonable.

I think these tests should be calculated to as nearly as possible imitate what the fabrics will be subjected to in the natural course of events. My idea for instance of testing drapery fabrics would be to put a sample curtain up in a room under the same conditions under which it would be used, and that should provide a very reasonable test, it seems to me.

I am glad I came tonight because I find now that the cloths which are going to be used by the Army from now on will never wear out and they will never fade (Laughter), so we will be able to do like we used to do in the family—hand down the clothes from father to son. (Laughter.)

But if this is already in effect I can't see why there should be such a serious deficit in the Treasury. However, I am somewhat comforted by the feeling that probably our taxes will be considerably reduced in the future. I know mine will be, from other causes. (Laughter.) I don't expect to pay as much income tax this year anyway. (Laughter.) Not out of the silk printing industry.

There was another thing in the Lieutenant's talk that rather disturbed me. I find the cotton dyer makes cotton goods for the Government and the silk dyer dyes some silk—it is only the little bits of thread, that don't count (Laughter)—and the wool dyer does considerable work for the Government, but where does the poor silk printer come in? Maybe the Lieutenant when he goes back can design some nice striped printed chiffon underwear to provide the necessary relief for the very much depressed silk industry. (Laughter.)

Anyway I am glad to see that the Lieutenant has checked and double-checked the checks. (Laughter.)

Lieut. Kirsner: I don't think I have any reply to make to that (Laughter) except that we find again there is a direct relationship between the fastness of colors on actual wear and, mind you, Fadeometer tests, and the treatment with lime and potash, and if anyone disputes that or wishes to be enlightened I will invite him to come down to our laboratory and we will show him. I think that would be interesting to a good many of you chemists.

As to the chemical gymnastics, we allow them to repeat anything they want and we show them everything we do. Ours is an open book and when they can convince us that something can be done better than we are doing it at present we immediately adopt that better method. But we always show them what we do. It is always open.

I think I can see the faces of at least four or five men who have gone through that experience right in our laboratory.

Chairman Gaede: Perhaps we ought to have a New York Section meeting down in the Philadelphia Depot—the Quartermaster's Depot.

Are there any further questions?

I am sure we have had a very profitable evening, first, with Mr. Swartz' talk on the Museum of Science and Industry and our visit through the Museum, and then with Lieutenant Kirsner's talk. I will entertain a motion for a rising vote of thanks.

Upon motion duly made and seconded a rising vote of thanks was extended to Lieutenant Kirsner.

The meeting adjourned at ten-fifteen o'clock.

The Worries of Wool Dyeing*

By Dr. E. W. Pierce
Ciba Company

WE had better start with the raw material as it is delivered to the dyehouse, and study, step by step, what outside influences can creep into the place and upset the best laid plans of the dyer to turn out perfect work. The stock is received either in the scoured or in the unscoured state. Stock that has been scoured by somebody else and dried may present several difficulties; if it is to be dyed in machines it may often show many white spots where no dye has ever touched the fiber. These are called air pockets, and in a sense they are, for the wool seems to hold very tenaciously to bubbles of air and prevent the dye from coming in contact with the wool at such places. A closer examination will show that the wool is quite waterproof at such places and resists being wet out at all. Whether the waterproofing is due to a previous carbonizing with Aluminum Chloride, or whether it is due to a lime-pulled wool forming insoluble soaps with the scouring liquor, cannot concern us when we are in a hurry to turn out the lot in the shortest possible time. In such cases it is sometimes possible to give the stock a hot acid bath before dyeing which decomposes the insoluble soaps and permits the wool to wet out evenly, but there are many cases where a previous souring is not practical, and in such it is necessary to use some wetting-out agent that will function in an acid bath and permit the wool to become thoroughly wet out in the dye. In such a case we must not use anything that will interfere with the subsequent dyeing operation. It is far better if the dyer can scour the wool himself and take it to his dye kettles or machines while it is still damp and so avoid the troubles that arise by dyeing wool that has been scoured and dried by someone else.

In scouring wool it is now pretty well established that a soap containing the highest amount of Sodium Oleate will wash out more fully and yield cleaner wool than the cheaper stearate or tallow soaps that are so much in vogue, or even the palmitate soaps. Virgin fleeces contain the natural wool sweat or suint which is supposed to require only a mild alkali for scouring, but we must remember that the fleece has probably been scoured several times while still on the sheep's back and has been contaminated by various sheep dips, antiseptics, and other chemicals, and the wool grease consists mostly of cholestrol, which is not saponifiable and hence will require a rather drastic treatment to cleanse it well enough to yield a perfect dyeing. A clipped fleece is a comparatively easy matter to handle, but the bulk of the raw wool now in commerce has been taken from tannery hides and is removed either by the lime or the sulphide process. Generally, sulphide-pulled wool has been treated in a lime bath subsequently in order to make it seem like the lime-pulled wool. Is there any doubt of the complications that may ensue by the action of the remaining lime salts in the soap bath used for scouring? Is there any doubt as to the origin of the waterproof spots that refuse to accept the dye? The addition of a little Tri-Sodium-Phosphate to the scouring bath will do wonders to fix the lime in a harmless condition, and will also assist in the emulsification of the greases. Economies practised in the scouring department frequently are the cause of still greater expenses in the later operations; no dyer can do good work on any material if the fibers are not in a clean condition before he starts to apply the dye.

There are irregularities in dyeing that come from other sources but no dyer can control these. The presence of "kemps," or dead wool fibers, is a defect in the stock, and if the mill tries to use such wool and expects the dyer to cover them, it cannot expect to have the best kind of dyeing—it must make a sacrifice of quality all along the line. Long-stapled wool which has become sunburned by long exposure to the weather cannot be dyed entirely level, and there is a doubt that the color is not as fast all along the fibers. Mixtures of wool from widely separated parts of the world are likely to dye differently, and

*Presented before the March Meeting of the Rhode Island Section.

a failure of the dyer to produce evenly dyed lots should not be held against him.

Much of the raw stock dyed today has been carbonized. Two main processes are in use: the sulphuric acid process and the aluminum chloride process, the dry process being used mostly for shoddy. After the acid process the main thing is to wash well in a soda bath and remove the last traces of acidity, but with aluminum there are always traces of the troublesome, resisting and waterproofing salt that remains in spots throughout the lot. Really, hydrochloric acid is the only chemical that will remedy matters, but dyers do not care to use it, as a rule. With acid dyes, the presence of aluminum does not seem to matter so much, but with alizarines and other mordant colors there is a great danger of discolorations. A chrome mordant will often displace the aluminum, but an after-chromed dye is much more sensitive. The fast acid dyes containing chromium in themselves are really the safest to use on such stock as they are less influenced by other metals.

Naturally we cannot expect to see as level a shade on any raw wool as we would see on noils or slubbing because the fibers will lie just as they grew on the sheep, and the difference between the root end and the weathered end is such that it will never dye exactly the same shade; but where the stock has been broken up by carding or combing, the fibers lie in all directions and so compensate and give the effect of a level shade. There is a variety of unevenness, however, that is of very common occurrence and causes much trouble. I refer to the blacks which are after-chromed (or top-chromed). The original dyeing of most of this class of dyes is a plum color, and the effect of the chrome is to change the shade to a black and at the same time to increase the fastness. It has been demonstrated that from three-fourths to one per cent of chrome is sufficient to oxidize a full shade of the average chrome black provided it is given time enough to act, but the usual custom is to use one and one-half per cent to two per cent of chrome to insure complete action and to avoid delay. I have seen many lots of wool dyed either in the old hand-poled tubs or in machines which were of poor shade and which bled badly in fulling, although laboratory dyeings of the same dye on the same stock were perfect. Investigation showed that when the chrome was added it had been absorbed instantly by some parts of the lot leaving but a trace in the liquor for the remainder of the wool, with the result that some of the lot was over-chromed and rusty in color while other parts of the same lot had not been acted upon by the chrome enough to change the shade or to fasten the color. Few dyers would add dye as recklessly as they add chrome, yet chromic acid on wool does not belong to the class of easily leveling colors, and no amount of boiling later will distribute it evenly, except in a neutral bath. Excess chrome also results in haspy wool and poor carding.

After raw wool we may consider shoddy and rags. There is little to be added to our knowledge of carbonizing except to state that now there is available a synthetic wetting-out agent that will form a lather in strong acid liquors, just as soap will in water, and it can be used to facilitate penetration and promote economy of the acid liquor. In former years much shoddy and rags were stripped and given a mordant by treatment with such excessive quantities as five per cent chrome and seven per cent sulphuric acid, much to the detriment of the already low grade fiber. Such a mordant might be suitable for logwood extract, but the great excess of free chromic acid present made it unsuitable for the better class of chrome mordant colors. Of course, results were obtained and the lots were passed, but the action of sun and weather soon gave the excess chrome a chance to do its work and the color faded as much as if a fast dye had not been used at all. Today most of the stripping is done by the prepared strippers of the Decroline and Protalin types. The former, being a basic zinc salt, requires more acid, while the latter needs little acid. Either may be preceded by a hot soda ash bath to remove the bulk of the more fugitive colors and so economize the stripping operation. Both need a wash in soda or ammonia afterward to remove any traces of material which would interfere with the dyeing. Neither of these materials will cause any tendering of the fiber if properly used and well washed out.

Slubbing is the next form of wool fiber to consider, for we can make no distinction between wool and worsted from a colorist's point of view. Although there are many types of excellent machines for dyeing worsted tops in balls, without matting and with far greater production, yet there are still many dyers who adhere to the old open box and dye in skein form, and others yet who use machines of the Klauder-Weldon type, and others of the Hussong type. There is little to be said in addition to the general rules of wool dyeing except that some types of machines do not provide for the dissolving of the dye in a separate tank; and where the water, or perhaps the dye, causes any difficulty in obtaining a perfect solution, the sediment is, of course, filtered out on the surface of the tops and cannot always be removed in the backwasher. A perfect solution of any dyestuff before being added to the dyebath is one of the first rules of good dyeing, whether it refers to wool, cotton, silk, or any other fiber.

A large proportion of slubbing is colored by the Vigoreux process whereby stripes of chrome printing color and mordant are printed on the material and the color fixed by steaming under pressure. There is a scarcity of fast colors in brilliant shades, particularly blues, violets and greens, but we are glad to say that means have now been found to print vat dyes on wool without tendering the fiber, and as soon as the mechanical means for handling such work can be provided we may expect to see an increase in this field.

In skein dyeing there are two main difficulties: the yarn either becomes felted while the dyer is trying to satisfy the exacting color sense of some color passer or designer, or else when the lot is finished it is found to consist of some light and some dark shades, although each skein may be perfectly even of itself. The answer to these troubles is not easy. Felting not only means too much mechanical action, such as results from turning, moving, and the agitation of the bath by the steam, but also from a predisposition to felt on the part of the wool on account of chemical treatment. We can restrain the mechanical action by the use of machines of the Klauder-Weldon type; we can keep the temperature just below the boiling point and get just as good results, and with acid dyes we will have very little trouble, but when we apply a chrome mordant to fine yarns we find that the tendency to felt is greatly magnified, and when we use colors, dyeing by the chromate process, the condition is but little better and we have more trouble in matching shades exactly. The top-chrome dyes cannot give the matches that are demanded on fine yarns and the shades are not permanent until the operations of manufacturing and wear have given the free chrome a chance to turn green and come to rest. The situation is not hopeless, for there are dyes of an intermediate class that contain in themselves the chrome mordant in a form that does not attack the fiber and they dye like acid colors until further boiling unites dye and mordant in an insoluble condition. Additions may be made at a boil for shading and the final result has all the fastness of a chrome mordant dye with the softness and feel of an acid dyeing.

The case of different shades in the same lot cannot be laid to the dyer. I was present in a dyehouse when a 1,000-lb. lot of carpet yarn was taken from a Hussong machine and was shown the two shades which ran about fifty-fifty in the lot and came from all parts of the machine, not some on the outside and others from the center, but a dark skein hung beside a light one, and all were perfectly even. We sent for the Super of the mill, for they made their own yarn. When the skeins were dried a blind man could have detected the difference in the feel of the skeins. We asked if the lot had not been spun from different wool mixing, but were assured that they mixed 10,000 lbs. at a time and all the wool was uniform, and further, that they had enough wool on hand for a six months' supply and always used the same mix. But he admitted part of the lot was spun on an English machine and part on an American, and he always noted that there was a difference in the lots even when they sent their yarn out to a job dyer. So this particular dyer has no further worries over the shaded lots, but there are many who have to dye yarns that are bought on the open market, and some Supers are not as easy to convince. Such shadings are mostly due to slight differences in the degree of twist, not noticeable to the naked eye, but which cause a different pattern or arrangement of the high lights and shadows, causing the same differences of shade that are to be noticed in two pieces of plush laid with the pile in different directions. This phenomena is the basis of many of the wool dyer's troubles with designers and color passers who generally know no more about matching colors than that they must look for absolutely identical appearance, and as it is not possible to make skein yarn, loose wool, slubbing, or woven pieces identical with either the water-colored, painted designs or with the slips of satin ribbon in the standard color card, in such cases the innate color sense of the dyer should be the deciding factor and thus save much valuable time and effort.

In dyeing piece goods we may encounter three main classes: woven goods, knit goods, and pile fabrics, although the pile fabrics mostly fall into the class of unions or two-fiber materials. Knit goods are mostly intended for sport wear and call for a class of dyes that have greater fastness to washing, salt water, perspiration, and such influences, than either the general run of men's, women's or upholstery goods. As the colors used on sport goods generally are of the class of neutral dyeing colors, which, however, need a small amount of acetic acid to complete the exhaust, the main consideration is so to regulate the temperature that the dye is absorbed slowly and evenly and not sprung on the fiber by the use of too much acid in the early stages, for this class of dyes will not boil even, as will the acid dyes, and any clouds or streaks in the first quarter hour will still be seen on the finished goods.

Piece-dyed wool goods for women's wear are generally dyed with the ordinary acid colors as the effects desired are more those of bright color than fastness; while in men's wear a maximum fastness to light is always looked for. The principal complaint that brings the dyer up to the perch, to look over a bad lot, is generally a shaded effect that makes the center of the pieces darker or lighter than the selvedges. In spite

of bagging or stitching the selvedges together and the failure to note any unevenness while the goods were still in the dyeing machine, the trouble has recurred day after day. While there may be many causes for such unevenness, yet the most of them may be traced to the drying. Frequently the color combination used to make the shade contains one dye in particular that exhausts much more slowly than the others and remains in the exhausted bath; such dyes as Wool Green S and Patent Blue V are of this sort. The washing after dyeing is often only a surface wash, and much of the exhausted liquor still remains absorbed by the fabric so that when the drying begins the edges dry first, and the water in the goods which still contains some color will spread out to dampen the already dried portion and thus feed it some more color, just a trifle, to be sure, but enough to throw the shade a bit darker. This same effect frequently takes place on cotton and silk goods, and bronzy streaks are the result. Another cause is found on goods that have been lightly napped before dyeing, but in most cases the clouds can be removed by a renapping after dyeing, because it is not the dye that is uneven, but the nap of the goods.

Men's goods are piece-dyed with the fastest acid dyes and the favorite combination is Fast Light Yellow 2G, one of the Alizarine Sapphire Blues, and an acid alizarine or fast acid red. Whatever combination has been used, there is always something to keep the dyer on the alert. The yellow is always the most slowly exhausting member of the group and remains in the bath till the very end with its habit of still adding a bit more to the shade after every add of the other colors, in efforts to get a perfect match. The first blue introduced, the SAP type, gave trouble on account of its changes in shade according to the temperature of drying and its sensitivity to salts; now there are several types to choose from, one dyer preferring one, and another dyer another. The red seems the weak member of the combination, as those having the best fastness are inclined to dye more rapidly than the blue, and also to remain on the surface of the fibers. They penetrate the fabric and the hard twists of the yarn, but the individual wool fiber is only colored on its outside until further boiling causes it to sink in deeper. This makes matching difficult because as the red goes inside and the surface effect becomes less, the yellow is adding its effect. The dyer may cut a swatch and dry it and order the lot washed, but in the slight time that has elapsed the shade will have changed enough for the lot to be rejected. Having mentioned these difficulties it now becomes an obligation to suggest some sort of practical remedy. Of course, a full, long boil and as complete exhaust as possible before taking a sample, and a half hour boil after each add, will do much to help matters, but I would prefer to set aside this class of dyes altogether and use the fast acid dyes containing chromium which work with much greater regularity and give even faster results. As an instance of the adaptability of such colors, it may be mentioned that all-wool blankets are now being dyed in pastel as well as heavy shades in this manner, and the makers of worsted and mohair pile fabrics have also found that this is the logical way to dye their goods to best advantage.

There is one more class of wool-piece dyes that needs a bit of comment, namely, the top-chromed colors leaving silk effects white. There are excellent chrome blues that chrome easily and change from the original red to a blue and which are used to a great extent by many dyers, but since it was found that Carmosine or Azo Rubine was of similar nature and would give somewhat the same sort of results the few cents difference in price led many to make the substitution, but the dyer has much more trouble in getting a full bright blue without a reddish cast and still having the silk clean without the necessity of a hydrosulphite bath to clear it afterward. When the chroming has not been complete there remains in the fiber still some traces of free chromic acid which will complete its work either in the dryer or when the goods are steamed or pressed, causing clouds and patches. If a dyer must use Carmosine, let him have a test made in the laboratory and see what shade he will get when it is fully chromed, and then aim to get this same shade in the dyehouse, but never resort to the use of Alizarine Green to kill the red cast due to insufficient chroming or the goods are likely to develop irregularities later on.

The entire subject of wool dyeing and its troubles is too long to be covered in a brief evening's talk, but as we have a period for discussion, it may be that some of those present have their own questions that can be taken up for the benefit of all of us.

MEETING OF NORTHERN N. E. SECTION

BEFORE the Northern New England Section, in Cambridge, on April 4, Dr. Olney spoke on Research, and John J. Healy, Jr., of the Merrimac Chemical Co., on "Chemicals in the Textile Industry: New Processes and Developments." Twenty-nine were at dinner and thirty-five at the meeting.

Announcement was made of committee appointments for the annual meeting on December 4 and 5. Of the General Committee, H. R. Davies is Chairman, W. R. Moorhouse is Treasurer, and A. H. Sampson is Secretary. Other members are Dr. Olney, and chairmen of subcommittees as follows: W. H. Zillessen, Dining and Enter-

tainment; Henry Grimes, Publicity; John Grady, Transportation and Sightseeing; Alex. Morrison, Registration; and Roland Derby, Reception.

At the last regular meeting of the section this spring, at Riverbank Court Hotel, Cambridge, on May 2, Dr. Walter M. Scott will speak on "Some Unusual Reactions of Cellulose," and Homer C. Riggs of the Rodney Hunt Machine Co. on "Some Recent Developments in Wet Finishing."

A committee under chairmanship of Walter Zillessen is arranging a June Outing.

Respectfully submitted,

HAROLD C. CHAPIN,
Secretary.

Chemicals in the Textile Industry, New Processes and Developments

By JOHN J. HEALY, JR.
The Merrimac Chemical Co., Inc.

THE chemicals that I am going to talk about are not new to any of us, but are the same old products that have been used day in and day out ever since textiles have been treated chemically. Sulfuric acid, ammonia, acetic acid and Glauber's salt are old historically but have been subject to some very interesting developments, from the process standpoint, in the last few years. It may be worth our while to get some knowledge of just what is going on in the manufacture of these chemicals and its effect on their economies.

Now I know that other chemicals are used by the textile industry, for instance organic solvents, wetting-out agents, etc., but these, I think, are by-products, in a sense, of developments in our old friends. For instance, as we shall see later, process changes in acetic acid and ammonia have led to production of some of these. The problem here is one of finding new uses for these compounds rather than new processes to make them and it is a problem. The index of "Chemical Abstracts" for 1930 lists approximately 28,000 different organic compounds which indicates the possibilities of the field. Only 1700 inorganic ones were listed.

Besides organics, the alkalis, of course, are extensively used by the textile manufacturer, but there have been no extraordinary developments in the manufacture of alkalis. The Solvay process, that is the ammonia-soda process, still accounts for all our soda ash and the greater part of our caustic and electrolysis of brine the rest of our caustic and all our chlorine. The market for caustic soda and soda ash is being cut into more and more by developments in other fields. The development of cheap ammonia is bound to affect this market as it makes this alkali available at a comparatively low price. Interest in other alkalis for special purposes, due perhaps to aroused interest in pH control, has replaced soda ash and caustic with tri-sodium phosphate, borax and the sodium silicates. However, there is no outstanding process change here which affects the whole industry.

The first of our chemicals mentioned, sulfuric acid, has been the scene of one of our recent outstanding developments, that is, the introduction of the vanadium contact mass. This has accelerated changes that were already taking place gradually. The first of these was the gradual tendency toward replacement of the chamber process by the contact process. The chamber process produces a comparatively weak acid, 60° Be. about 75 per cent sulfuric. Up to 1900 all sulfuric was made by this process and when stronger acids were desired it was necessary to concentrate the chamber acid by evaporating off the water. About 1900, the conditions necessary for the production of sulfuric acid anhydride, SO_3, by the oxidation of SO_2 thru contact with platinum and other catalysts, were thoroughly investigated in Germany and the contact process became an established fact. This process permits the production of any desired strength of sulfuric from 1 per cent to 107 per cent, the equivalent acid content of a 30 per cent oleum, by dissolving the sulfuric anhydride in a solution of sulfuric of the proper strength. There was no great demand for the strong acids, however, until the war when strong sulfuric was necessary for the nitrating acids used in making explosives. The development of our own dye industry and the gasoline business have since increased our strong acid requirements, so that today 39 per cent of the sulfuric produced in this country is made by the contact process. Vanadium mass simplifies construction of a contact plant so that the investment required today is no greater than for a chamber plant of the same capacity and this fact combined with its great flexibility as regards acid strength has swung the balance to the contact side. The chamber process has been improved, particularly abroad, in the direction of increasing the rate of reaction and cutting down the space required, but no permanent increase in the strength of the acid produced has been obtained. In 1930 all new acid construction was contact.

Another important change brought about by vanadium was in the raw materials used as a source of sulfur. Iron pyrite, FeS_2, was the original source. This contains only about 50 per cent sulfur, requires a complicated system for its combustion, results in a very dusty burner gas which must be cleaned, and leaves a residue of two-thirds its weight of iron oxide after burning, which is a nuisance to dispose of. It was known that large deposits of pure sulfur were located in Louisiana and Texas but no economical method of mining them was developed until 1902. At that time, Mr. Herman Frasch conceived the idea of

melting the sulfur where it lay underground by piping hot water down to it. Then by forcing air down another pipe, this molten sulfur could be forced up a third pipe and solidified in blocks. This method was so successful that by 1920 practically all the sulfuric made in the United States was made from sulfur. In 1927, however, it was reported that the sulfur deposits were practically exhausted and no new ones were in sight. The price of sulfur immediately jumped from twelve dollars to twenty-one dollars a ton. As roughly three tons of acid can be produced per ton of sulfur, this was equivalent to a boost of three dollars per ton of acid. It was cheaper to use pyrites even though a much larger investment for burners and purification systems was necessary. The vanadium process simplified the system so much that enough saving in investment and nuisance charges is realized to overcome the difference in raw material cost and sulfur is the raw material used in up-to-date contact plants. Our supply of sulfur, meanwhile, has been assured by the discovery of new sources, but the price has not come down.

Now, in order to understand more completely the simplifications brought about by vanadium, it is necessary to go back into history. It had been known since 1800 that by passing hot sulfur dioxide over a material offering a large surface, such as pumice or finely divided platinum, some oxidation to sulfur trioxide took place. No practical application was made of the knowledge until 1900 when a German, Knietsch, thoroughly investigated the conditions of temperature and rate of gas flow necessary for the reaction. Knietsch's process worked very well in the laboratory but poorly in the plant and the reason seemed to be that the plant gases, which were obtained by burning pyrite, contained small amounts of arsenic and chlorides which poisoned the catalyst, that is prevented it from bringing about the reaction. It was found that the gas could be freed from these poisons by removing all traces of dust and acid. A certain amount of acid is formed in the burning of the ore since some of the SO_2 is oxidized to SO_3 and this condensed with the moisture normally present in the air used for combustion. Elaborate purification systems were necessary for purification such as dust collectors, acid scrubbers, coke filters, etc. This purification system had another disadvantage besides cost; it cooled the hot burner gases. Now the conversion of the burner gas takes place most rapidly at about 750°F. and so the gas had to be reheated. The saving in heat that could be obtained if the hot burner gases could be used directly was appreciable.

Vanadium completely changed the picture because as far as we know, it is not poisoned. Therefore, if a source of sulfur dioxide is used which is dust free, the scrubbers, etc., could be eliminated and the hot gases from the burner run directly into the converters. Sulfur, of course, is the ideal dust-free source of SO_2 as it is 99.5 per cent pure, and the elimination of the cost of the purification system offset the increased price for raw material. Acid in the gas must still be guarded against to prevent corrosion of equipment. This can be done by drying the air before combustion. If no water is present of course no combination of sulfur trioxide and water can take place to form sulfuric acid. The modern contact plant consists of a dry tower for the air; then a blower for forcing the air and gas thru the system; a burner into which liquid sulfur is fed; the converters containing vanadium mass where oxidation takes place; and an absorption tower in which the acid gas is absorbed in strong acid. The process could not be much simpler, altho one can conceive of mixing sulfur and water in a pot and bringing out acid. This is perhaps easier said than done. The thing to be remembered about vanadium is that it is not poisoned. It is true that its first cost is cheaper than that of platinum but most of the platinum used can be recovered when its usefulness is over, so that the actual difference is small.

Now, from the economic side, there seems to be a gradual tendency to eliminate the use of sulfuric acid in many processes. Nitric acid is now largely made by the oxidation of ammonia, not by the action of sulfuric on nitrate of soda. Synthetic acetic has cut down the amount made from acetate of lime and sulfuric. Phosphoric acid is now made to some extent by an electric furnace process. The old method was to treat phosphate rock with sulfuric. The petroleum industry has used large quantities of sulfuric to remove sulfur from gasoline. Recent indications are that sulfur is not so harmful and the use of sulfuric can be partially or wholly eliminated. The new hydrogenation processes for refining petroleum remove the sulfur as hydrogen sulfide. This does away with the use of sulfuric and makes available a new source of sulfur so that the petroleum refiner may be changed from a consumer to a producer of acid. The extent to which these changes have already taken place cannot be estimated on account of the large change in consumption figures that has taken place anyhow in the past year. However it is undoubtedly something that the manufacturer must face eventually.

The next and probably the most important of the chemicals from the process point of view is ammonia. The production of synthetic ammonia is the outstanding chemical engineering feat of the century. In 1925 there was none on the market. All our ammonia was a by-product of illuminating gas manufacture. Its price, gas in cylinders, was $.37 a pound. In 1930, 140,000 tons of anhydrous ammonia were produced and the price was $.15 a pound. That's progress. The importance of ammonia to the textile trade lies not so much in its use but rather in the effect that it has had and is going to have on the manufacture of acetic acid and on economic developments in the Glauber's market.

Synthetic ammonia was a German development and

there is a lot of credit due them for it. It is easy to see that one volume of nitrogen and three of hydrogen could combine to form two of ammonia and that increase in pressure should make the reaction more complete as there is a reduction in volume. But it took courage to apply the pressures thought necessary for the original process.—250 atmospheres, 3,750 pounds per square inch was unheard of then, altho today it is considered low and many plants are operating at 1,000 atmospheres, 15,000 pounds per square inch.

Fundamentally all synthetic ammonia processes are the same, that is, a mixture of nitrogen and hydrogen at a comparatively high pressure is passed over a catalyst at about 500°C. and more or less conversion results. The ammonia is recovered and the unconverted gases re-used. All ammonia processes require two things; cheap power and cheap source of hydrogen. The various processes differ in their source of hydrogen and in the pressure used.

Abroad the cheapest source of hydrogen is coke oven gas which contains 50 per cent hydrogen, 25 per cent methane, and 10 per cent carbon monoxide. Over here water gas, obtained by passing steam thru hot coke is cheaper altho some plants favorably situated can use electrolytic hydrogen. Water gas is essentially 50 per cent hydrogen and 37 per cent carbon monoxide, with small amounts of hydrocarbons. Now the hydrocarbons and carbon monoxide must be removed as they are catalyst poisons and various methods are used such as chilling, compressing to liquefy, or fractionation at high pressures. All processes seem to agree, however, that the best method for removing the last traces of carbon monoxide is to convert it to wood alcohol by combining it with some of the hydrogen already present, in the presence of a catalyst. This should be kept in mind.

There are three distinct processes from the pressure standpoint; the Haber, 3,750 pounds per square inch; the Casale 11,250 pounds per square inch; and the Claude, 15,000 pounds per square inch. Higher pressure results in better conversion and the ammonia is obtained in liquid form. I am going to give a brief description of the Claude process, which is perhaps the most popular today.

Water gas is scrubbed under pressure with water. This removes hydrogen sulfide and carbon dioxide. The gas is further compressed then to about 300 pounds per square inch and most of the carbon monoxide and the hydrocarbons except methane are liquefied. This carbon monoxide is removed and used for other purposes. The gas is then passed over a suitable catalyst at 450°C. and the rest of the carbon monoxide is converted to methane. Air is now admitted to obtain nitrogen. The oxygen so introduced is burned to water and carbon dioxide with the methane and both eliminated. The gas is compressed to 1,000 atmospheres filtered to remove oil passed thru four separate catalyst tubes at 500° C. and the ammonia trapped and removed.

The production of ammonia synthetically has had important effects on the production of chemicals generally and organic chemicals particularly. In the first place an organic compound, methanol, is actually synthesized as a part of the ammonia process. Naturally the success of this synthesis has focused attention on this method of producing other organics and particularly ethanol for which there is a much larger market. In the second place, the necessity for obtaining a cheap, pure hydrogen has developed several good sources for this material so essential to organic synthesis. For carbon we have abundant cheap coal, for oxygen the air, and now for hydrogen we have developed water gas, coke oven gas, natural gas and electrolysis as cheap sources. Finally synthetic ammonia has helped to perfect equipment and technique for the handling of very high pressures. Many organic syntheses proceed the more rapidly the higher the pressure and the successful use of high pressures in the production of ammonia assures their success for these other purposes. Undoubtedly the production of many of our organics will be influenced in the next few years by one or all of these three factors.

Ammonia has already had a direct effect on the production of acetic and Glauber's. The production of cheap methanol has led to attempts to use it as a source of synthetic acetic, and has affected the price of acetate of lime. The use of ammonia as the raw material for nitric acid in place of acid and nitrate of soda has materially decreased supplies of nitre cake, affecting in turn the production of salt cake and Glauber's salt.

Now for acetic which today is the scene of many attempts to develop new processes. This is all due to rapid increase in its consumption brought about by the development of lacquers and acetate silk. Of course all our acetic up to four or five years ago was made from acetate of lime resulting from the distillation of wood. Methanol was the other principal product. Now cheap synthetic methanol came into prominence just at the time that acetic consumption was increasing by leaps and bounds. This latter was a big help to the wood distiller at first, as it enabled him to cover his losses on methanol by raising the price of acetate of lime. Everything was fine for a while but the rapidly growing market and the high price for acetic attracted other people into the field. A synthetic process was already available, its chief requirement being cheap power. Water power developments were just entering the large-scale stage and everything coincided so nicely that in no time synthetic acetic was an active competitor. This competition has recently resulted in a severe price cut in acetate of lime from $4.50 in July to $2.00 now.

The synthetic process mentioned is the so-called car-

bide process. Calcium carbide is made by the reduction of calcium carbonate with coal at a high temperature. An electric furnace is ordinarily used. The calcium carbide is treated with water to form acetylene and the latter is readily transformed to acetaldehyde which in turn is oxidized to acetic. Catalysts and suitable temperatures are necessary. This is an interesting example, by the way, of the production of an organic chemical starting with the inorganic materials; limestone, water, and coal.

The question of the cheapest way to produce acetic has not been settled yet, however. The wood distillers are making every attempt to retain their market, and are paying a great deal of attention to acid and alkaline hydrolysis processes for direct conversion to acetic. The recovery of the acetic made this way is facilitated by extraction processes which dissolve acetic from the gaseous or condensed vapors in suitable solvents. The solvent mixture is distilled to recover acetic and the solvent reused. This avoids, of course, the intermediate formation of acetate of lime. The big drawback in these wood processes is the cost of concentrating the acetic which is usually obtained as a very weak solution. The synthetic processes produce a strong acid directly.

Other synthetic processes are being considered. Natural gas is cheap and abundant and can be converted to acetic. In Italy it is said that petroleum oils have been decomposed electrolytically to form acetic. Methanol can be used as a starting point for another process. The first two of these processes are complicated by the production of a number of by-products which must be eliminated or sold at a profit to make the process successful. All three are still experimental.

One other class of processes must be considered and that is fermentation from cheap natural raw materials. The production of vinegar, a weak acetic solution, has been a fermentation process for years. Ethyl alcohol from the fermentation of molasses can be converted catalytically to acetaldehyde and acetic. A new market for ethanol would be a big help to the producers, in view of its present situation. Fermentation processes in general have the disadvantage of producing a number of by-products and weak acid. The first and possibly the second can be overcome by increase in our knowledge of ferments.

The carbide process seems to have the upper hand now. However, in view of the constantly growing demand for acetic these other processes are bound to receive considerable attention. It may well be that the decision of the question of how our acetic will be made will decide also how our organic chemicals are to be made. The battle is between cheap power and cheap natural raw materials.

Glauber's is the next and last of our heavy chemicals. The developments in Glauber's are economic. No new process has been developed. The same old one of dissolving salt cake, neutralizing to remove iron and other impurities, filtering and crystallizing in open pans or on continuous machines being the standby. Now salt cake is a by-product of the manufacture of muriatic and the amount of it produced depends upon the demand for muriatic. Muriatic can be produced by either of two methods, salt and nitre cake or salt and sulfuric. The first results in only one-half as much muriatic per unit of salt cake as does the second and represents more closely the relative demand for the two products. Nitre cake of course is the by-product resulting when nitric acid is made from sulfuric and nitrate of soda. Here synthetic ammonia steps in as a new and more convenient, in most cases, raw material for nitric acid production. No nitre cake is produced, however, when nitric is manufactured from ammonia, and consequently its supply has been materially decreased and its price advanced. This naturally is reflected in the price of salt cake and Glauber's. Other industries have their effect. The sulfate pulp manufacturers are taking more salt cake every year. In order to keep up with the demand the manufacturer is forced, on account of the lessened supply of nitre cake, to use the second reaction with con-equent over-production of muriatic.

The muriatic market in turn is threatened with a new competitor, synthetic acid from cheap chlorine and hydrogen. Losses on muriatic, then, must be made up on salt cake, and Glauber's prices tend to go up. We have, however, natural deposits of sodium sulfate in abundance and these will undoubtedly come into the market and stabilize it when prices reach the right point. At present prices, natural sulfate is too far away from the market and freight rates make its delivered price too high. New uses for muriatic, too, would change the picture.

That, I think, is the whole story. I hope I have been able to give you some idea of the changes that are taking place in the manufacture of these old, familiar chemicals. There is something doing every minute. Thank you.

Mr. Grady: I would like to ask Mr. Healy if the use of muriatic is increasing?

Mr. Healy: I wish I could say yes. But, it isn't increasing, principally on account of the price, I think.

Mr. Grady: I suppose you mean gas muriatic carbonizing?

Mr. Healy: I only know of one concern that has recently gone into that. Only four in N. E. that use it as far as I know. The principal disadvantage seems to be that most of the people carbonizing have their equipment installed and muriatic gas carbonizing requires additional investment for equipment. Apparatus to turn out 2,000 pounds of goods a day would cost $10,000. It is much cheaper to put the money into acid and alumina chloride carbonizing.

Mr. Grady: You can't put muriatic on there and pack the goods, can you?

Mr. Healy: The goods will get a pinkish tinge.

Mr. Grady: Will it remove the *pink* if it is cold? (This word should be "alumina," I think.)

Mr. Healy: Yes, that is, I think so. I can say "yes." I don't think you can deny it, perhaps it is a question of leaving it in long enough. I think perhaps these troubles are due to the fact that sometimes a mixture of goods is used, a mixture of wool carbonized by acid and alumina chloride. In that case, you will get streaky effects because some of your goods has alumina and the rest hasn't.

Mr. Grady: If one was carbonized, say the warp with vitriol, and the other with alumina and they were both in the batch, would the sulfate affect the alumina?

Mr. Healy: Most sulfuric goods are neutralized. If the acid were left in the goods the tendency would be to form alumina sulfate. How effective it would be, I don't know. Some carbonizers are whitening wool by giving it a bath in alum. A bit more about muriatic gas carbonizing. I think that it is the ideal process. You subject your goods to a volatile acid, muriatic; the process is carried out at about 180° F. and consequently you get minimum damage to the goods. You have complications in that iron equipment is ordinarily used and is attacked by the muriatic. This may result in a deposit of iron on the goods with consequent yellowing of white goods.

Mr. Grady: Is hydrochloric acid added to the aluminum chloride in aluminum chloride carbonizing?

Mr. Healy: Aluminum chloride is an acid salt on account of hydrolysis. There is no excess muriatic present, no free muriatic except that which results from the hydrolysis of the aluminum chloride in the solution. Muriatic is absorbed by the wool from aluminum chloride solutions so that the bath tends to become basic, that is it has a larger amount of alumina present than is necessary to combine with the muriatic. It is advisable to bring it back to its original condition by adding muriatic.

Mr. Rose: Is there any danger of the sulfur supply becoming exhausted?

Mr. Healy: We have enough sulfur now. We have supplies which will last us a good long while, but it was a fact that two or three years ago the sulfur supply was getting low. However, the sulfur producers have not come down in the price.

Mr. Rose: In this vanadium mass process, is it necessary to remove the poisons? Are they poisonous to the catalyst or would they affect the quality of the acid?

Mr. Healy: The poisons are usually arsenic or chlorides. Now, arsenic is not present in sulfur and of course in this process, sulfur is generally used as raw material. The arsenic would tend to go through and give a high arsenic acid, but it can't happen in the case of sulfur. Chlorine can't be retained because it is volatile.

One other thing I forgot to mention is that there is a tendency to consider a synthetic chemical such as ammonia as pure, but it must not be forgotten that the old ones made by the old method are just as pure. In fact, they have to be in order to compete.

Mr. Rose: What is the catalyst in synthetic ammonia?

Mr. Healy: Usually iron and traces of other metals called promoters. They are usually kept secret. Their action like the action of catalysts in general isn't thoroughly understood. Take an iron catalyst and add traces of nickel or cobalt or manganese, until you get one that works, and that is the one to use.

SIXTY-SIXTH MEETING OF THE RESEARCH COMMITTEE

THE Sixty-Sixth Meeting of the Research Committee of the American Association of Textile Chemists and Colorists was held at the Chemists' Club, New York City, Friday, April 17, 1931, at 2:50 P. M.

The following were present:

Chairman, Prof. L. A. Olney
Wm. D. Appel
H. R. Davies
Dr. Carl Z. Draves
Ephraim Freedman
Dr. Jos. F. X. Harold
Walter E. Hadley
B. L. Hathorne
H. F. Herrmann
Dr. E. H. Killheffer
Ed. F. L. Lotte
Harold W. Leitch
Wm. R. Moorhouse
Dr. Hans Meyer
Dr. D. H. Powers
Dr. Robert E. Rose
Dr. Walter M. Scott
Alex. Morrison, Secretary

Besides letters of regret at inability to attend from Council members as recorded in minutes of 73rd Council Meeting, a telegram of regret was received from A. E. Hirst.

Chairman Olney announced that the other members of the Research Program Committee he was authorized to appoint at the last meeting were Wm. D. Appel, Dr. Carl Z. Draves, and Dr. D. H. Powers. The Committee had met during the forenoon and Mr. Appel at the Chairman's request outlined the future research policy and program as decided by this Committee.

At present Dr. Milton Harris, our new Research Associate at Bureau of Standards, is working on the determination of the Iso-Electric Point of Wool and Action of Light on Boiled-Off Silk.

The Committee is anxious to start on some project in connection with cotton. The Study of Deterioration of Cotton by Light and the Study of Shrinkage of Cotton Fabrics are being considered, but the Committee is desirous of obtaining more suggestions of cotton subjects from the members at large as well as from the members of the Research Committee. Any who have suggestions are earnestly requested to communicate with Prof. L. A. Olney.

Chairman Olney, in the absence of Hugh Christison, Chairman of Sub-Committee on Fastness Tests for Dyed Wool, reported on progress of this Committee on Fulling Tests.

Wm. D. Appel, in the absence of Wm. H. Cady, Chairman of the Light Fastness Sub-Committee, discussed the report this Committee is editing for publication in the near future.

Chairman Harold W. Leitch of the Sub-Committee on Material and Construction of Dyeing and Finishing Machinery reported some progress.

Chairman B. L. Hathorne of the Sub-Committee on Rayon reported progress and led a very lengthy discussion on the term "Rayon," and to what it should refer. No definite conclusions were reached, although the majority present seem to feel it should include all fibers formed by forcing a colloidal solution through a small orifice, and that a descriptive adjective should be used to differentiate between several types.

The Chairman read a letter from the Morgan Dyeing & Bleaching Co., written by Ed. W. Morgan, Chairman of the Mid-West Section, its President, asking for information in regard to resisting Rayon, and several members promised to give the Chairman information to transmit to Mr. Morgan.

The meeting adjourned at 5:00 P. M. to meet next in Boston on May 15th, 1930.

Respectfully submitted,

ALEX. MORRISON,
Secretary.

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Arnold, D. Dewey, overseer dyeing and bleaching, Appleton Co., Anderson, S. C. Sponsors: Chas. H. Stone and John D. Hunter.

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JAMES WILLIAM STANLEY

JAMES WILLIAM STANLEY, editor of SILK since 1926, and connected with the textile publishing business for many years prior to that date, died on May 2 at the home of his sister in Bellemore, Long Island, N. Y. Mr. Stanley, who was 54 years old, was operated on for appendicitis two months ago, complications following the operation resulting in his death.

In his passing the Howes Publishing Co., and his co-workers in the organization which publishes this paper, have suffered a keen personal loss. Jim Stanley was one of those rare characters who face life with a smile regardless of its difficulties. Loyal, always cheerful, conscientious and hard working, he carried on during recent years under physical handicaps which would have been insurmountable for most men. He had a host of friends in the silk industry who will mourn his passing.

Born in New York, Feb. 12, 1877, he passed most of his childhood at Montgomery, N. Y. He planned originally to become an architect, but his interests soon centered in newspaper and publicity work. He was on the Baltimore Sun for a number of years with Wells Hawks. In 1906 he entered theatrical publicity work with the press department of Charles Frohman in New York. Soon afterward he went on the road as manager of May Robson in "The Rejuvenation of Aunt Mary," which played in most important towns in the United States and Canada for a period of 90 weeks, a record for those days.

He managed a number of Maude Adams' greatest hits, and acted as manager for a number of other outstanding stars of the stage, including William Faversham and Edna May.

Jim Stanley was at heart a newspaper man, however, and he re-entered this field as editor of "Dry Goods." He was with the American Silk Journal, New York, for a short time, and then went with the Silk Publishing Co., New York, at that time publisher of SILK. In conjunction with the publishers he launched, in 1921, the SILK DIGEST WEEKLY, serving as its editor until 1928. For several years after the purchase of these two papers by the Howes Publishing Co. he edited both of them, building up a large circle of friends in the silk manufacturing industry.

In 1922 Mr. Stanley was the victim of food poisoning which nearly robbed him of his life. He was seriously ill for two years, and returned to his desk with a partial paralysis from which he never recovered. Undaunted by this terrific handicap, he continued his work with unbroken courage to the end.

He was a widower; a 12-year-old daughter and two sisters survive him. Funeral services were held on May 5 at East Orange, N. J., his home for many years, and interment also was at East Orange.

LOSS OF LIGHT DUE TO SMOKE

ACCORDING to a report recently issued by the United States Public Health Service, the contamination of the atmosphere by smoke from the chimneys of private houses, office buildings, industrial plants, steam engines, and steamships has become a serious matter in several of the larger cities of the United States. The Public Health Service claims that the presence in the air of large numbers of particles of soot and ash, and of appreciable amounts of sulphuric acid and other impurities results in injuries to trees and plants and in economic loss, and is a detriment to health.

The Public Health Service in finding that the injury to health is due, in part, to the loss of daylight caused by the smokiness of the atmosphere has brought up a problem which should be of interest to a dyer. It would seem that if there were enough smoke in the air to reduce the light so much that the health of individuals were effected, there would also be good reason to believe that this same smoke was the cause of slow results obtained many times when exposing dyed samples for fading.

Textile chemists and others interested in the testing of dyestuffs and dyeings might do well to investigate fur-

ther the facts that the Health Service found in regard to amount of smoke in the atmosphere.

The Public Health Service set out to find, as far as possible, the exact amount of light that is lost because of smoke at different seasons of the year and at different times of the day; and also the extent to which the loss of light is affected by the height, shape, and density of the smoke layer, the humidity of the air, the velocity and direction of the wind, and by other factors. Simultaneous records of daylight were made on the roof of the United States Marine Hospital at the lower end of Manhattan Island where the air is unusually smoky, and on the roof of a building at the U. S. Quarantine Station on Hoffman Island in lower New York Bay, where the air was comparatively clear. The recording instruments used were a type that has been in government use for some time and consisted of photoelectric cells and recording potentiometers.

The photoelectric cell was placed on the roof of the building where the study was to be made, and the recording potentiometer was placed conveniently within the building. The platform was of such height that no shadows were cast upon the cell, and was also constructed so that the cell was accessible for cleaning.

Comparison of the results obtained at the two places showed that there was a large relative loss of light at the Hudson Street Hospital due to smoke. In some cases the average hourly or daily loss was greater than 50 per cent. The average percentage loss for an entire year was 16.6 for clear days, 34.6 for cloudy days, and 21.5 for all days. The results showed that the loss of light depends, among other things, upon the altitude of the sun, upon the nature of the daylight, upon the relative humidity of the air and upon the velocity of the wind.

The effect of altitude of the sun on the loss of light was shown clearly by the varying percentage loss for different hours of the day. The average percentage loss throughout the year was 30.2 at 8:30 a. m., 16.5 at 1:30 p. m., and 21.0 at 3:30 p. m. Seasonal influences showed no marked effect, but the average monthly relative humidities did have an effect, the percentage loss usually increasing and decreasing with the relative humidity.

Other conditions being the same, the average percentage loss of light was greater for cloudy days, the percentage loss being about 1.5 as great for cloudy days for relative humidities between 40 and 80 per cent; and for wind velocities, between 10.0 and 19.9 miles per hour. For a clear sky the average percentage loss was twice as great for a relative humidity of 65 per cent as for 35 per cent. For a cloudy sky the increase with relative humidity was not as great. The percentage loss of light was also found to decrease as the velocity of the wind increased.

In view of the great interest that is being taken at this time in fading and fading tests, it seems that the above information might well be taken as a basis for further investigation with particular reference to the dyers' problems.

Fall Season Card

The confidential advance issue of the 1931 Fall Season Card was sent out recently to members of the Textile Color Card Association.

Eighty shades in all appear on the new card, which portrays the fashionable color families for daytime wear, as well as new renditions of "off-white" tints, soft pastels and vibrant exotic hues. The latter interpret the French Colonial theme and are particularly important as accent notes, to be allied with one of the basic shades.

The tinted whites in the faintest nuances of blue, yellow, green, grey, blush and mauve, express high fashion notes smartly adapted to evening wear, brides and bridesmaids' gowns, as well as blouses.

In the group of daytime shades, particular significance is accorded new versions of brown, which is expected to prove the outstanding basic color for Fall. These include rich hues of ruddy cast, deep yellowish browns shading almost to black, and an extremely high style range of greyed browns. Animated rust tones are also highlighted on the card, as well as two new ranges of red. All of these color families strongly reflect the French Colonial influence.

The blue family is represented in a vibrant gamme, as well as clear navies. Greens of slightly yellowish cast are expected to retain their popularity. The remaining color ranges on the card comprise new beige tones, taupe grey and purple.

New Vat Color

Ponsol Brilliant Violet 4R Paste, a vat color which produces bright bluish shades of violet, has been developed by the Dyestuff Department of the du Pont Company. Although of greatest value in the printing industry, it may also be used for dyeing cotton and silk. It is redder than Ponsol Brilliant Violet RR Paste and equally as bright. It is claimed to be exceptionally fast to practically all of the most important destructive agents.

The Paste is printed best by the pigment method. Due to its fastness to washing and water, it should be used extensively for shirtings and dress goods that must undergo repeated launderings.

Klipstein Company Moves

E. C. Klipstein & Sons Co. removed their offices on May 1st last from Newark, N. J., to the eighth floor of the new Empire State Building at 5th Avenue and 34th Street, New York City.

Since the control of A. Klipstein & Co. was acquired by American Cyanamid Corp., the dyestuffs manufactured by E. C. Klipstein & Sons Co., notably sulphor black, are being sold through Calco Chemical Co. The intermediates manufactured by E. C. Klipstein & Sons Co., whose client is at South Charleston, West Virginia, are, however, being sold by them direct from their own office.

The Determination of Inorganic Non-Volatile Impurities in Sulfonated Oils

By **RALPH HART**

AN INTERESTING article by Nishizawa and Winokuti[1] on a new method for the determination of sodium sulphate in sulfonated oils recalls the method developed by the writer[2] some time ago —now official with the American Leather Chemists Association—for the determination of total inorganic impurities in such products. According to that method the inorganic impurities are obtained indirectly from the per cent ash, organically combined SO_3 and fixed alkali bound as soap. It is based on the fact that upon thorough ashing of a sulfonated oil, the following reactions must necessarily take place:

1. The fixed alkali or sodium bound as soap is converted into sodium carbonate, as follows: R—COONa $\rightarrow Na_2CO_3 + CO_2 +$ etc.

2. The sodium salt of the organically combined SO_3 is changed into Na_2SO_4 and free sulfuric acid or the anhydride, which may or may not escape, as follows: $2R—O—SO_3Na \rightarrow Na_2SO_4 + SO_3 + CO_2 +$ etc.

3. The ammonium salt of the combined SO_3 is converted into ammonium sulfate and ammonium soap is changed to ammonium carbonate, both of which are ultimately volatilized.

4. The free sulfuric acid formed in (2), in the presence of sufficient alkali, will be found in the ash as sodium sulfate, as a consequence of its interaction with the alkali of the soap or carbonate. In the absence of sufficient soap or carbonate, however, part of the sulfuric acid is volatilized.

Sodium Sulfate in Ash

The foreign salts and other non-volatile impurities in the sulfonated oil remain in the ash and obviously correspond to the difference between the latter and the sum of the sodium sulphate and sodium carbonate formed upon igniting the oil. With the one exception to be stated below, the sodium sulfate due to organically combined SO_3 is readily calculated by the following formula:

$$\%Na_2SO_4 = \left[\frac{A_s}{2} + A_f\right] \frac{Na_2SO_4}{2\,KOH} \left[\frac{1}{10}\right] =$$

$$\left[\frac{A_s}{2} + A_f\right] \left[\frac{142}{112}\right] \left[\frac{1}{10}\right] = 0.1268 \left[\frac{A_s}{2} + A_f\right]$$

Where A_s represents the organically combined SO_3 expressed in mgms. KOH per gram and A_f the fixed alkalinity due to sodium soap, similarly expressed. Evidently one-half A_s corresponds to the non-volatile part of the combined SO_3 and A_f to the free SO_3 that is neutralized by the carbonate. The rest of the formula is self-evident.

It will be noted that A_f becomes zero in the absence of fixed alkalinity or soda soap (though ammonia soap may be present). Moreover, A_f becomes negative in the case where all or part of the sulfate radical has been neutralized with ammonia, thereby automatically compensating for the loss of SO_3 due to the volatilization of $(NH_4)_2SO_4$ formed during ignition. However, the algebraic sign of A_f (which is one of the terms used in calculating combined SO_3 by the volumetric method) is taken care of by the formula used for its determination.

In all cases thus far considered there will be no carbonate left in the ash, being displaced by the liberated sulfuric acid. A special case arises however when the amount of sodium carbonate in the ash is more than sufficient to neutralize all of the free sulfuric acid, i. e., when A_f is greater than A_s. In that event total sodium sulfate in the ash is represented by A_s only, since none of the combined SO_3 is lost. Hence there are two cases to be considered, namely:

Case I—When A_f is less than one-half A_s (i. e., in the absence of carbonate in the ash).

$$1A.\ \%Na_2SO_4 = 0.1268 \left[\frac{A_s}{2} + A_f\right] = 0.624\ (A_s + 2A_f).$$

Case II—When A_f is greater than one-half A_s (i. e., in the presence of carbonate in the ash).

$$2A.\ \%\ Na_2SO_4 = 0.1268\ A_s.$$

Sodium Carbonate in Ash

The sodium carbonate in the ash will now be considered. This is given by the following formula:

$$\%Na_2CO_3 = \left[A_f - \frac{A_s}{2}\right] \frac{Na_2CO_3}{2\,KOH} \left[\frac{1}{10}\right] =$$

$$\left[A_f - \frac{A_s}{2}\right] \left[\frac{106}{112}\right] \left[\frac{1}{10}\right] = 0.0946 \left[A_f - \frac{A_s}{2}\right]$$

Evidently the term $\left[A_f - \frac{A_s}{2}\right]$ when positive corre-

1. Nishizawa and Winokuti, Chem. Umsch. 38, 1 (1931).
2. Hart, J. Am. Leather Chem. Assn. 15, 404 (1920); 16, 159 (1921).

sponds to the excess sodium carbonate left in the ash after all the free sulfuric acid had been neutralized. It was shown above that when A_f is less than one-half A_s that there can be no free carbonate in the ash, in which case the formula yields a negative result. In that event the carbonate term should be replaced by zero. On the other hand for all positive values of the formula sodium carbonate must be present in the ash. Hence here as in the case of sodium sulfate there are similar conditions to be considered, namely:

Case I—When A_f is less than A_s or when $\left[A_f - \frac{A_s}{2}\right]$ is negative.

1B. $\%Na_2CO_3 = O$.

Case II—When A_f is greater than A_s, or when $\left[A_f - \frac{A_s}{2}\right]$ is positive.

2B. $\%Na_2CO_3 = 0.0946 \left[A_f - \frac{A_s}{2}\right] = 0.0473 (2A_f - A_s)$.

Total Inorganic Impurities

The combined sodium sulfate and carbonate in the ash, due to igniting the oil, may now be found by combining the above formulas, as follows:

Case I—When $\left[A_f - \frac{A_s}{2}\right]$ is negative, (i. e., in the absence of carbonate.

3. $\%Na_2SO_4 + \%Na_2CO_3 = 0.0634 (A_s + 2A_f)$.

Case II—When $\left[A_f - \frac{A_s}{2}\right]$ is positive (i. e., in the presence of carbonate).

4. $\%Na_2SO_4 + \%Na_2CO_3 = 0.1268\ A_s + 0.0473 (2A_f - A_s) = 0.0795\ A_s + 0.0946\ A_f$.

In applying the formulas, it is probably more convenient to substitute for A_s, its equivalent (S) per cent combined SO_3. This relation evidently is as follows:

$$A_s = 10 \left[\frac{112}{80}\right] S = 14\ S.$$

Making this change in formula 3 and 4 respectively the following are obtained:

Case I—When $(A_f - 7S)$ is negative.

5. $\%Na_2SO_4 + \%Na_2CO_3 = 0.0634 (14S + 2A_f) = 0.1268 (7S + A_f)$.

Case II—When $(A_f - 7S)$ is positive.

6. $\%Na_2SO_4 + \%Na_2CO_3 = 0.0795 \times 14S + 0.0946\ A_f = 0.0946 (11.77S + A_f)$.

The inorganic impurities, including the sodium sulfate or sodium chloride present as such in the original oil, may now be found as follows:

Case I—When $(A_f - 7S)$ is negative (i. e., in the absence of carbonate in the ash).

7. % Inorganic Impurities = % Ash — $0.1268 (7S + A_f)$.

Case II—When $(A_f - 7S)$ is positive (i. e., in the presence of carbonate).

8. Inorganic Impurities = % Ash — $0.0946 (11.77S + A_f)$.

When the method was first proposed, the last two formulas were applied to data on sulfonated oils published by C. G. Bumcke,[3] with the following results:

The agreement between the two methods are remarkably close. It is to be noted that the writer has not further investigated this method from an experimental point

3. Bumcke, 14, 515 (1929).

TABLE I

Inorganic Salts by the Direct Method and Inorganic Impurities by the New Method

Data by Bumcke	No. 3	No. 4	No. 7	No. 10	No. 13
Combined SO_3, per cent	1.95	1.91	1.93	2.65	2.00
Na_2O as soap, per cent	0.205	0.520	1.35	0.369	0.25
Ash, per cent	3.05	4.46	5.14	6.01	2.51
Salts, per cent	0.74	1.51	0.71	2.79	0.16
Calculations by New Method, Formula used					
Combined SO_3, per cent (S)	71.94	71.91	81.94	72.28	72.00
Fixed alkalinity, mgms. KOH (A_f)	3.70	9.40	24.5	5.80	4.52
Na_2SO_4 due to combined SO_3, per cent	2.19	2.89	3.43	2.92	2.34
Na_2CO_3 due to soap, per cent	None	None	1.04	None	None
Salts and Impurities, per cent	0.86	1.57	0.67	2.92	0.16
Salts and Impurities, difference between the two methods, per cent	—0.12	—0.06	+0.04	—0.13	0.00

of view, but considers the close agreement shown in Table I and the fact that it has been in use for a number of years as an official method would tend to establish its reliability. It would be desirable, however, that the method be more thoroughly examined experimentally and its status definitely determined. The procedure obviously is very simple.

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Baby Whale Mixer

The dye specks in piece goods and yarns, caused by improper dissolving of the dyestuff may be removed by the use of the "Baby Whale" Model 5c sold by Herbert Hinckley, Inc. This machine takes the dyestuff and the water and mixes them intimately. It is claimed that the machine actually grinds the water and the dye, thus providing a better suspension of the dyestuff. The machine is automatically motor driven and may be plugged in on any light socket. It is believed that thru the use of this machine there will be a big saving on preventing seconds and spoiled goods.

Motor driven mixer on brackets.

Plane Speeds H T H to Nicaragua Earthquake Victims

Transporting chlorine in an airplane might appear to be a rather hazardous undertaking. But when American Red Cross planes recently rushed emergency supplies to the stricken area in Nicaragua, the chlorine carried was in the safe, highly-concentrated powder form of H T H.

The disastrous earthquake which destroyed the city of Managua and its water supply system brought disease in its wake to add to the already heavy toll of lives. Chlorine for sterilizing and disinfecting was urgently needed, together with antitoxin, to avert further tragedy. An appeal sent out to Washington brought quick action.

At 11:30 A.M. on Saturday, April 4th, a rush call for H T H came over the telephone from Government officials at Washington to the Philadelphia Office of The Mathieson Alkali Works. Less than one hour later, at exactly 12:29 P. M., a special truck delivery from the local warehouse was completed at League Island Navy Yard and the shipment of H T H was placed in the waiting Red Cross plane. At 1:30 P.M., with a supply of antitoxin also on board, the plane took off for Nicaragua.

In another recent earthquake disaster, that in New Zealand, H T H also was rushed to the stricken areas and served to check the outbreak of disease through its immediate use for emergency chlorination. Here again its high concentration and easy application were important factors, although stocks were already on hand with the local agents, S. W. Peterson & Company, Ltd., Wellington, N. Z.

Technical Notes from Foreign Sources

Action of Light Upon Dyeings

R. Haller and C. Ziersch—Zeitsch. f. angew. Chem. 43, 209 (1930).—A continuation of H.'s work upon the general topic cited. In the work covered by the present paper, the authors have examined the effect of irradiation upon samples of American and of Egyptian cotton, variously dyed and variously pretreated. All classes of dyestuffs were tried out. Exposures of the swatches was for a period of about 100 fading-hours for each side of the weave. As soon as exposure was completed, tests were made for the presence of peroxide. The degree of fading was determined by means of the Pulfrich step-photometer, in accordance with the Ostwald color-system. The study, due largely to Z.'s influence, is really a new method for determination of the degree of fading. By means of the optically measured values for the black and white content of the dyeing, the so-called fading numbers can be determined, alteration in tone being purposely ignored in this connection; and so a simple and generally true expression can be worked out for all dyestuffs and for all shades. A table of numerical results is given, of the experiments carried out; it contains the commercial name of the dyestuff, its group, the method of dyeing, the presence or absence of peroxide after fading, the value for alteration in tone, the degree of fading, and the loss in strength of the fiber.

By way of supplement, a study was also made of the possibilities of influencing the fading by after-treatment of the swatches before irradiation. The authors find that for the improving of light-fastness sodium metaphosphate and thiourea are the best agents to use for after-treatment, both because they are fairly effective, and also do not alter the shade of the dyeing.

Wash-Extracts and their Preparation

R. Krings — Seifen-Sieder-Zeitg. 1929, *S.* 137 (*Dr. J. Davidsohn in Monats. f. Textil-Ind.* 45, 208 (1930). —Washing extracts are concentrated, thick, liquid potash soaps, with a fatty acid content which should never fall below 40 per cent. Such products, which have come into notice during the past few years, show an effort in the industry to produce more effective detergents than are as yet available. There have been 3 types of these products distinguished. The first, and oldest type, was the Savonade, put out in 1920 on the basis of German Patent No. 365,160; it consisted of a high-percentage liquid potash soap with a high content in solvent fluids, among which hexaline and methylhexaline were the most common. This Savonade was used principally in the industry as a cleansing agent for very oily, grease-smeared goods. After a few years there came in a whole series of other very effective fluid-solvent soaps, which one could also classify as wash-extracts; they found industrial use on the largest scale in kier-boiling, etc. Many efforts have been made to prepare such mixtures without the use of organic solvents as additions, for these solvents depress the frothing power of soaps. There is also a demand for extracts which boil off less readily.

Apparently, for the preparation of these extracts one can use the same oils and fats which are used for the preparation of the soap itself, which is to be used as the base of the preparation. Some agent is added at the end, in order to keep the product fluid, so that it can be stocked in bottles, etc.; but it is not stated what this liquifying agent is.

Fundamental Principles of Wool Washing

Dr. S. (abstr. from Text. Jour. Austr.)—Textil-Chem. u. Colorist 11, 59 (1930).—The method employed in washing wool is of the greatest importance for the whole of the process through which the wool must pass before it is turned out upon the market as finished goods. Improper washing leads to trouble, invariably, in the dyeing and finishing. The first part of the task is to cleanse the raw material. Justin Mueller has recently carried out some interesting studies into the nature of the different foreign substances present in the raw stock, and the possible ways of removing such substances; these studies have been published in the Bull. de la Soc. Ind. de Mulhouse, and take up the microscopic investigation of the action of water, soda, and soap, the quantitative determi-

After these additions have been made, the temperature is raised within 30 minutes to the boil, and gentle boilnation of loss of weight of large lots of raw wool, and the nature of the waste wash-liquors.

In raw wool, the fibers are surrounded by foreign matter, so that the characteristic fiber-markings of the material are not visible. On treatment with water, a part of the superficial dirt-coating is dissolved, another part is removed in the insoluble form, the fiber-bands thus becoming visible. Only crystals remain adherent to the wash-water were recovered. The material thus washed was divided. The first portion, 500 g., was washed twice in warm water, then dried. The second portion, 500 g., was thoroughly scoured by treating twice, for 5 minutes each treatment, at 45° C., in a bath of 7 liters of water, 15 g. of soda (3% of the weight of material) and 15 g. of soap (3% of weight of material). It was then thoroughly rinsed in water, and dried. Microscopic examina-

tion of the latter lot (the one scoured with soda and soap) showed a completely cleansed fiber, the cholesterine crystals being completely removed.

The following are the figures for the determinations made:

a—Wt. of raw wool (Lot I) ..... 500.0 g.
Wt. after washing, air-dry..... 260.5 g.
Loss of wt. ..... 239.5 g.
= 47.9%
Wt. of raw wool (Lot II)..... 500.0 g.
Wt. after soda-soap scouring, air-dry..... 244.0 g.
Loss of wt. ..... 256.0 g.
= 51.2%

b—Analysis of residual water, a brown, weakly alkaline liquor:

	Per 1 Kilo	% on Raw Wool
Potassium as $K_2CO_3.2\,H_2O$...	34.89 g.	3.49
Total fatty substances, crude..	130.00 g.	13.00
Insoluble matter, removed mechanically	108.00 g.	10.80

c—Analysis of the soap-soda bath:

	Per 1 Kilo	% on Raw Wool
Wool—grease and wax.....	50 g.	5.0
Fatty matter from soap.....	19 g.	1.9
Wax-like substances (cholesterine, etc.)	31 g.	3.1
Total content of crude fats from the two wash-processes	130 g.	13.0
Total of wax-like substances..	31 g.	3.1
	161 g.	16.1

The following conclusions, important for practical wool-scouring, may be drawn from the author's work: the raw wool contains sufficient potash to remove all of the wool-grease, the lanoline, through emulsification. The grease can be removed by water alone, by employing suitable methods of washing, at about 50° C. After such a washing, which will also mechanically free the wool from other foreign substances, as earth, particles of cellulose, etc., only the waxy substances remain. These waxy substances, principally cholesterine and iso-cholesterine, cannot be saponified in the ordinary way by alkalies, such as the potash naturally contained in the raw wool, for such substances are not of the nature of ordinary fats or oils, i.e., are not (at least easily) saponifiable. They are, however, easily scoured off by emulsification, on which account the presence of soap in the scouring bath is really essential for the complete cleansing of the wool. But if no unsaponifiable waxes are present, then a simple treatment with water would be sufficient to remove the actual fats and saponifiable waxes, for the potash present in the raw wool would be able to accomplish this.

Testing for Indigosols Upon the Fiber

J. C. Livingston—Tiba 1929, *p.* 1195—It is ordinarily impossible to decide whether a given dyeing has been carried out by the vat method or by an Indigosol, that is, as far as the characteristics of the dyestuff upon the fiber are concerned. But the point can be decided by a test upon the fiber itself, as follows: the goods are stripped with alcoholic hydrosulphite according to Driessen's method (Rev. gen. Mat. col. 1908, 178), well washed, and then boiled with a Methylene Blue solution of 0.025%. The sample is then washed, dried, and examined. If it has taken on a blue color, then it was originally dyed with an Indigosol, whether developed with an oxidizing agent or by steaming. If the sample remains uncolored, the dyeing was carried on in the vat. The origin of this blue color in the fiber when so treated cannot be due to the presence of oxy-cellulose in the fiber, for the author found that undyed material, treated with cholorate or nitrite as for dyed goods, but without the Indigosol, did not give the test. There seems to be no reason for explaining the test by the presence of hydrocellulose. The author's view is, that the Indigosol-dyed fiber has fixed upon it sulphur dioxide, as the latter is liberated, in the nascent state—liberated in the transition from Indigosol to true dyestuff; and that this sulphur dioxide adheres tenaciously to the fiber, its presence accounting for the reaction with the Methylene Blue.

Indanthrene Dyestuffs

G. Rudolph—Kunst-Seide 12,358 (1930).—A general and at the same time somewhat detailed treatise in brief upon this group of dyestuffs, well-written and thorough, as all of Rudolph's papers are. Three and two-thirds full pages are devoted to a tabulation of the Indanthrene dyestuffs, covering the general method of dyeing to be used with each brand, the per cent of dyestuff, both ratio, temperature of vatting, amounts of caustic and hydrosulphite, color of the vat, assistants needed, temperature of dyeing, special aftertreatment, alternative methods of dyeing, and remarks. A thoroughly fine paper, worthy of fuller discussion.

Blue Vat Dyestuffs, Benzanthrone Series

German Patent No. 438,478 (18/*XII*/'26)—*I.G. Farben-Ind. A.-G.*—A superstructive development of two earlier patents.

G. P. No. 259,370 covers the production of oxidation products of dibenzanthrones. G. P. No. 436,829 covers the formation of certain vat dyestuffs by action of aldehydes (or their polymers, or substances liberating, or reacting like, aldehydes) upon these oxidation products. The present patent takes these vat dyestuffs and halogenates them, in the presence of a non-aqueous medium (organic solvents or liquids are particularly considered, but sulphuric acid containing a little water, e.g., common concentrated acid, may also be successfully used). The products obtained are blue dyestuffs.

New Bausch & Lomb Catalog

Of special interest at this time to Chemists and Colorists is the announcement of the Bausch & Lomb Textile Catalog. The company has made an extensive study of the needs of the Textile Laboratory, wherever Optical Instruments can be applied.

The 100 page book contains valuable information, well worth having at hand, as well as the description of several very interesting instruments not described in detail in the literature, such as the Textile-Chemical microscope, the pH Colorimeter, and the Universal Spectrophotometer, and the Quartz Spectrograph.

New Indigosol Blues

The Carbic Color & Chemical Co., Inc., have placed on the market two new Fast Indigosol Blues which are believed to be of particular interest to the trade. They are claimed to fill an important gap in the present range of Indigosol colors. So far no Indigosol of Indanthrene fastness has been vailable and it is claimed that the new colors are not only faster to light than any of the older types of Indigosol Blue but are also exceedingly good to soaping and chlorine.

Improved Permutit Chemical Feed

The Permutit Company has developed a new improved Chemical Feed-Type B for which is claimed many new advantages. It is believed that it will find its widest application in conjunction with lime soda water softeners.

New Quarterly Price List

For better serving its customers the Roessler and Hasslacher Chemical Co. has prepared a new Quarterly Price List to take the place of the monthly list which they have been using for the last forty years. You are invited to consult with them regarding your chemical problems.

Weather-O-meter Booklet Available

The Atlas Electric Devices Co. has recently published a catalogue which contains complete detailed information regarding the Weather-O-meter. This instrument is useful as a medium for accelerated reproduction, study, and measure of the reactions of sun, rain, washing, cold, and heat. They are also planning in the near future the distribution of similar catalogues regarding the Launder-O-meter and the Fade-O-meter.

Quaker Chemical Products Corp.

On Jan. 1st, 1931, the Quaker Chemical Products Corp. purchased all the outstanding Common and Preferred Stock of the Quaker Oil Products Corp. The Quaker Oil Products Corp. had been organized since 1919, manufacturing and merchandising chemical specialties, catering especially to the textile industries. The two companies have merged and have been entirely reorganized. The laboratory staff is prepared to develop new products and improve the present ones.

Mid-Summer Millinery Colors

The Color Conference Committee of the Eastern Millinery Association in cooperation with the Textile Color Card Association, has selected a special group of millinery colors for mid-Summer promotion, it was announced by Margaret Hayden Rorke, managing director of the last named organization.

These Summer shades, which will be widely stressed by all factors of millinery and allied lines, are chosen from the following cards of the Textile Color Card Association: Standard Eighth Edition, Spring 1931 Season and Summer 1931.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

WANTED

An experienced practical Dyer who can successfully make exact matches of shades in raw stock skein dyeing by hand and on Hussong Dyeing Machines and on Package Dyeing Machines, in all types of colors, such as Direct, Vat, Sulphur and Developed Colors. No one without successful practical experience need apply. In application state actual experience and give references from previous employers and state salary at which you are willing to begin work. Position open at once for right man. Bibb Manufacturing Company, Macon, Georgia.

POSITION WANTED

DYER — COLORIST — CHEMIST — available: 10 years' experience with Dyestuff Manufacturing; 10 years' experience with Silk-Rayon Dyeing concern. Address Classified Box No. 675, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Connection with a growing organization, with a moderate investment, is desired by a chemical engineering graduate with 15 years' experience in the application of dyestuffs to textiles, dyeing and printing in the laboratory and mill. Address: Classified Box No. 673, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

First-class dyer and general all-around man. Can take a Superintendent's position. Knows the trade thoroughly. Practical Dyer for years on all classes of cottons, silks, crepes and celanese, for printing or plain shades. Now employed as Superintendent. Address: Classified Box No. 674, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.